Gas Journal

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Editorial Notes

Folkestone Prepares

PRELIMINARY attention was drawn in these columns a short while ago to the Annual Conference of the Association of Public Lighting Engineers which opens at Folkestone next Monday, when we took the opportunity of urging gas engineers and all those interested in the retention and development of our valuable public lighting load to make a special effort to be present. A good attendance from the gas side is desirable for at least two excellent reasons—first, it is only right that the Industry should give its fullest support to this year's "gas" President, Mr. C. I. Winstone, Public Lighting Superintendent of the Gas Light and Coke Company, who is well-known for his good work in the public lighting of the Metropolis; secondly, a good muster of the Industry is desirable as a mark of recognition and appreciation of the splendid efforts of the manufacturers, who have co-operated wholeheartedly in the magnificent display of gas street lighting, which will do much to convince those who are still unconverted as to the suitability of gas for this purpose.

A recent drive through the streets in which the demonstration units have already been put into operation enables us to suggest that next week will find Folkestone one of the brightest spots in the British Isles—if present indications are anything to go by. And one of the principal contributors to the nocturnal brilliance of its streets will, of course, be gas, whose pre-eminence in the field of public lighting is being demonstrated by what bids fair to be the finest practical display of street illumination that has ever been staged in this or any other country. Folkestone is a particularly appropriate venue for the annual gathering of such a body as the A.P.L.E. because the normal public lighting of the Borough is divided fairly equally between the two media which lay chief claim to be able to illuminate the streets in a satisfactory manner. The aims of the Association include the improvement of the street lighting of the country, and, consequently, the greater safety of the travelling public after nightfall. And the Association has a reputation for fair-mindedness in this respect which is very creditable in an organization which must essentially embrace rival interests. Each alternate year its Presidents are drawn from the gas and electrical sides, and a happy balance is drawn between opposing views in the all-important interests of progress.

Some two hundred gas lighting units will contribute to Folkestone's "night life" during the period of the Conference, embodying materials representative of all the leading lamp and lighting equipment manufacturers. The gas demonstrations involve more than a dozen separate installations, covering three miles of streets within the "square mile" which has been allotted to the lighting displays, and each lamp is controlled by catalytic ignition which obviates the need for continuously burning by-passes. Appropriate cards descriptive of the lamps, equipment, class of illumination, &c., are to be attached to the end column in each installation, with a similar one in the centre. These cards will be fitted at eye level, and will enable delegates and others to see at a glance the type of installation and to judge its merits. There will be, in addition, examples of gas floodlighting at the Pavilion Hotel and the Kingsnorth Gardens, both of which will ably indicate the excellence of gas for this purpose. Nor should it be assumed that these displays are mere "stunts" or exhibitions of brilliant illumination; they are, on the contrary, practical demonstrations of lighting applicable to the requirements of the particular thoroughfare in which the units are erected, and the fullest information of each installation is available for those who may wish to "buy" them. In short, Folkestone will become a showroom for public lighting.

Much of the "staff work" in connection with the gas displays has inevitably fallen upon the shoulders of the President, who has from the first been determined that the splendid opportunity offered by the Folkestone Conference of putting up a really noteworthy demonstration of gas lighting should not be allowed to pass unheeded. The gratitude of the whole Industry is therefore due to Mr. Winstone for arranging so fine a showing for gas, in the successful achievement of which he has been greatly assisted, of course, by the unstinted co-operation of Mr. G. le B. Diamond and his colleagues of the Folkestone Gas and Coke Company as well as that of the manufac-

turers. It is not, we feel, too much to say that the Folkestone Conference of the A.P.L.E. will focus greater attention than ever before upon the importance of good lighting in the interests of public safety on the roads. And it lies to a large extent with the Gas Industry itself—according to the measure of support which it brings to the Conference—whether or not that attention is directed to the contribution gas can offer to the better lighting of our streets.

The Industry will join in congratulating Mr. Winstone upon the honour which has been accorded to him and his Company by his election to the Presidency of the Association of Public Lighting Engineers and in wishing him all success in his task of piloting the course of the Conference; and the best way the Industry can express its feelings is to present a " united front " at Folkestone next week.

Coke Crystallography

Carbonization technologists generally will find much to interest them in the fundamental " long-range " research now being undertaken at Armstrong College, Newcastle-on-Tyne, by Prof. Riley. There has been much discussion—for example, at the Chemical Engineering Congress last year—upon the advisability or otherwise of engaging in long-range research in industrial laboratories. Some hold that industrial research must be severely practical and designed to deal with the problems of the moment or problems clearly envisaged as arising within a short period of time; there can be no doubt, however, that pure research work which may one day be found to have practical application is peculiarly suitable for the Universities, even if the cost is borne by industry. The basic ideas underlying Prof. Riley's researches have been thus set forth in the 1936 Annual Report of the Northern Coke Research Committee: " The molecular picture of solid carbon provided by X-ray investigations has shown that such problems as crystallite size, packing and shape, inter-crystallite adhesion, the accessibility of the inter-planar surfaces to various reagents, adsorption effects, the presence of metallic electrons, the presence and rôle of chemically bonded hydrogen, oxygen, nitrogen, and sulphur, the relationship of the parent structure of a coke to that of the parent coal, &c., all require further investigation before any clear understanding will be gained of the factors which influence such commercially important properties as coke strength and combustibility."

There can be no doubt that the fundamental initial properties of coke are settled by the phenomena occurring during the plastic stage. This subject has been discussed in our columns upon other occasions, and most carbonizing technologists understand the rôle played by the semi-fluid matter, by internal pressure in the plastic zone, and similar phenomena in deciding whether a coal is to yield a strong or a weak coke. After the semi-coke has been formed at temperatures in the neighbourhood of 450° C., however, the plastic matter becomes solidified and we are left with a spongy, light material containing much hydrogen—and other constituents—which are driven off by heat to produce hard coke. What are the characteristics of that coke depends partly on what has already happened during the plastic stage, and partly what happens during the further period of heating. It is to this post-plastic period, if we correctly assess the potentialities of his work, that Prof. Riley's investigation refers.

These ideas are based on the crystallographic character of carbon. It has been customary to divide the common forms of carbon into two—graphite and amorphous carbon—and it has now been shown that the differentiation between these forms is less fundamental than had been supposed. In the ideal graphite crystal, the carbon atoms are arranged in flat planes, situated at the corners of regular vicinal hexagons (like a number of " benzene rings " closely interlocking) so that each carbon atom, except at the extreme edges of the crystal, is joined to three others. These planes are situated 3·4 Å units apart. It has been further shown by X-ray analysis that many of the amorphous carbons contain micro-crystals possessing a lattice structure similar to that of macro-crystalline graphite. This conception is exactly akin to the structure of coke. There are portions, consisting of carbon-hydrogen complexes, which may be amorphous; there are micro-crystals, or " crystallites;" and there are macro-crystals. As the temperature to which the coke is heated is increased, the proportion of amorphous material decreases, the crystallites increase in size and number, until they become crystals. These changes are accompanied by increased hardness and decreased combustibility.

Penetration of Crystal Planes

When a carbon crystal is attacked by oxygen, by CO_2, or other reagents, there are two lines of attack. One of these is at the edges, and the other is by interplanar penetration. As the temperature of the formation of the coke becomes higher, the size of the crystallites becomes greater, so that the edges available are less extensive. It appears probable that in high-temperature coke the only considerable avenue of attack is through penetration of the crystal planes. This in turn depends upon the size of the molecule which seeks to penetrate. No doubt at high temperatures the space between the layers becomes larger; certainly gaseous molecules are at high temperatures to some extent dissociated, the extent depending upon the temperature, and thus penetration becomes more easy. Prof. Riley has studied the oxidation reaction by methods involving wet oxidation, particularly the oxidation of cokes by mixtures of chromic acid with phosphoric or sulphuric acid; it has been found that there is a remarkable similarity between the structure of graphitic oxide and the complex formed between active carbon and oxygen. An interesting calculation made by other workers in this field is to the effect that the interplanar surfaces in 1 lb. of carbon amount to 1,200,000 sq.yd.—approximately 10 million times its macro-surface—so that the relative accessibility of the various surfaces must play an important part in determining the properties of carbon. This work should result in giving us a clear physical picture of the processes of the combustion of coke, and the other reactions in which coke is used. It will enable us to know what should be the structure of coke likely to give any particular properties that may be desired. Whether with this knowledge we shall be any nearer practical methods of obtaining those structures than we are to-day is uncertain. Time alone will show. The best efforts of the research worker are too often defeated by economics, and it so often happens that practice runs ahead of theoretical knowledge so that the effect of research is explanatory rather than hegemonic.

The structure of coke is closely interwoven with the

production of active carbons. To the physicist, coke, active carbon, graphite, and other forms are no more than differing crystallographic arrangements of the carbon atom. It may be possible in the future for us to control absolutely the characteristics of coke by the addition of small amounts of foreign substances, accompanied by blending to modify the behaviour of coal within the plastic range. It is already clear that although the phenomena of plasticity govern the formation of coke, the formation of the layered lattice typical of the graphitic crystal begins very early in the carbonizing process, being probably a packing effect brought about by the flat plate-like shape of the individual molecules of the coal. Normally, coal is a non-conductor of electricity, but at about 450° to 500° C. it becomes conducting; it is interesting to notice that the hexagon planes in the graphite crystal are held together by the metallic valencies which give graphite its electrical conductivity. At a little higher temperature, generally about 700° C., there is a pronounced and critical rise in the electrical conductivity of coke; this is apparently due to the liberation of volatile matter, because there is evidence that the electrons which are responsible for electrical conductivity are concerned below 700°C. in the bonding of hydrogen and hydrocarbons in the interplanar surfaces. About this temperature, as we have previously indicated, the crystallites grow into crystals which have no absorptive power for gases and are with difficulty combustible. Thus Prof. Riley is giving us a very lucid explanation of the changes that occur in the structure of coke during the carbonizing process.

If, on the other hand, we wish to produce active carbons, or easily combustible coke, a procedure is open to us. It will already be evident that there is probably no such thing as amorphous carbon in coke; it is impossible to avoid crystallization, because the basic forms of the crystal structure are already present in coal. It is therefore necessary to modify this structure so that a greater area will be present for absorption. It is significant that molecular oxygen cannot be absorbed by graphite for a reason which is probably purely steric—namely, that the dimensions of the oxygen molecule are greater than the distance apart of the crystal layers, 3·4 Å. The work of Berl on the nature of active carbons has shown that the activation process consists essentially in increasing the accessibility of the interplanar surfaces of the graphite lattices in the individual carbon crystallites. This is effected by decreasing the size of the crystallites by controlled oxidation until the carbon assumes the mesomorphic state. This is a special form of distortion only to be found in very small crystallites, in which the individual lattices are split up into small packets of hexagonal planes which may be so small as to consist of only one layer plane—in effect a two-dimensional crystal lattice, a phase partaking simultaneously of the crystalline and the amorphous. It is a problem of the future to discover how the crystal structure of coke can be modified in this way, as is already being done for active carbons, and so produce a highly reactive coke without sacrificing gas yield.

West's Gas

It is four years since West's Gas Improvement Company first published a Summer Number of their house organ *West's Gas*. It was an ambitious effort, but succeeding years saw the publication of special issues maintaining the high standard and interest value set by the first number. The 1937 Summer Number breaks new ground in that it is not concerned with gas but presents a series of articles giving glimpses of the wonders of Nature, all representing the personal experiences of the authors in places and scenes widely distributed the world over. The reader is taken across the Atlantic on the maiden voyage of the *Queen Mary*, to the Canada of the Hudson's Bay Company and Yellowstone Park in North America, and over the Andes in the South. Across the Pacific he is conducted to Japan, Hong Kong, Australia, and New Zealand, and in the Indian Ocean is shown scenes in Upper Burma. There are articles on the Wild Game Preserve in South Africa, on the Iranian Oil Fields, on the life and scenery in Poland, Russia, and Denmark. The entire volume is of absorbing interest, and once again we congratulate the Company and the Editor of *West's Gas* on a publication of which they may legitimately be exceedingly proud. It is certainly assured of a very warm welcome by the Gas Industry.

Migration?

Far-sighted gas administrators—and who could expect successfully to control a gas undertaking without looking well ahead?—have doubtless taken note of all that has been said and written on the subject of the actual, or possible, migration of industries from the North to the South of England, and so they will be specially interested in the Survey of Industrial Development in Great Britain during 1936, which has been issued by the Board of Trade. It is the intention that this survey shall indicate what is the trend of development as shown by the number of factories opened, extended, and closed during the year, and the statistics are of an encouraging character.

They are encouraging because they show that, while, as compared with the preceding year, the number of new factories opened was greater, the number closed down was very substantially less. The number of extensions was precisely the same as in 1935. The survey is also reassuring to those who are anxious that the spread of industry and commerce over the country should not be unduly disturbed by migration, because the conclusion drawn from the figures is that, like its predecessors, the present survey provides no evidence of a drift of industry to the South, in the sense that new factories in the South are the results of transfers from the North. As a matter of fact, the result of the 1935 survey was to indicate, on balance, a movement in the opposite direction. Last year, as in 1935, in all the industrial groups except textiles, the number of factories opened and extended was greater than the number closed.

Naturally, industrialists are influenced by a number of factors in the choice of a site for the location of activities, and an effort has been made to classify these in a large number of cases. Convenience of premises and suitability of labour are well ahead of other factors listed, but cheap land, low rent, or low rates account for quite a number of decisions. There must, however, be other reasons as well to account for the fact that, out of a total of 551 new factories in 1936, no fewer than 261 were opened in Greater London. Thus, while there may be no evidence of a drift of industry to the South in the sense that new factories in the South are the results of transfers from the North, there is obviously a strong tendency for new industrial operations to concentrate upon Greater London, though there is also evidence of very satisfactory development in some other directions.

In This Week's "JOURNAL"

Croydon Company's Mains Extension.

An interesting mainlaying job has recently been undertaken by the Croydon Gas Company with a view to supplying the potential needs of the growing residential district of Addington, the ultimate development of which is estimated to be in the region of 10,000 houses. The first 4,500 are already being fully carcassed for gas.
See p. 530.

Modern Fixing Practice.

Mr. R. N. LeFevre, Officer-in-Charge of Training, Gas Light and Coke Company, in the course of an interesting article, draws attention to the valuable contribution which the use of Rawlplugs makes to modern gasfitting practice where it is often necessary to fix appliances firmly to walls and be sure that they will remain secure under working conditions. A series of diagrams clearly illustrates the actual application of Rawlplugs to various gasfitting jobs.
See p. 531.

Physical and Chemical Properties of Coke.

Reference to the physical and chemical properties of coke is made in the Annual Report of the Northern Coke Research Committee for the year ended Dec. 31, 1936. It is stated that the Committee's policy of encouraging the closest collaboration between producers and users of coke has been continued, and to this end the representation of blast furnace interests on the Committee has been further strengthened. One of the most serious obstacles now hampering attempts to improve the quality of commercial coke and its efficiency in the blast furnace is the definite lack of fundamental knowledge of the formation and nature of coke. The Committee has initiated researches designed to remedy this deficiency, and the results obtained, while being of considerable intrinsic interest, have also provided valuable information relating to the more fundamental aspects of coke formation and combustion.
See p. 536.

Prevention of Holder Discoloration.

Messrs. John R. Skeen and A. L. Ward, of the Chemical Laboratory, The United Gas Improvement Company, discuss the systematic search for a possible and satisfactorily economic control of holder discoloration. The ideal method consists, they state, in the creation of an unsuitable environment for organism growth, requires a minimum of attention, represents a low investment and maintenance cost, and involves no serious secondary difficulties. There were two immediate objectives: (1) To determine the pH range least favourable to organism growth, and (2) to add substances having a direct bactericidal action. It was found that under average conditions, normal sodium carbonate was most suitable for adding after the initial concentration of sodium dichromate.
See p. 537.

Personal

At a meeting of the Board of the British Oxygen Company on Aug. 26 Dr. J. DONALD POLLOCK was elected President of the Company and Mr. S. J. L. HARDIE, Chairman of the Board.

Dr. Pollock, who was the former Chairman, is Chairman of Metal Industries and a member of the Scottish Milk Marketing Board. Mr. S. J. L. Hardie, formerly Vice-Chairman of the Company, is Vice-Chairman of Metal Industries, and Chairman of several other companies with associated interests.

Sir ALEXANDER STEWART, Chairman of Commonwealth Industrial Gases, Ltd., of Australia, was elected to a seat on the Board.

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Alderman J. BARLOW, aged 83, Chairman of Accrington District Gas Board, was congratulated by members, on Aug. 26, on his enrolment as a Freeman of the Borough.

Obituary

The death took place on Aug. 24 of Dr. FREDERICK RUSSELL TUNKS, who among other interests was a Director of the Midland Tar Distillers and Tar Residuals, Ltd.

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The death is announced of Mr. HEWSON BONSOR, formerly a representative of the Wellington Tube Works, Ltd., in which capacity he will be remembered by many friends. Mr. Bonsor died on Aug. 20 at Southport, where he had lived since his retirement. The funeral was at Witton Cemetery, Birmingham, on Aug. 24. He was aged seventy-five.

Forthcoming Engagements

Sept.

2.—GAS COMPANIES' PROTECTION ASSOCIATION.—Committee Meeting, 5, Victoria Street, S.W. 1, 2.30 p.m.
6.—LONDON AND COUNTIES COKE ASSOCIATION.—Technical Committee, 2.30 p.m.
6.—4th Meeting Arthur Duckham Memorial Fund Committee, 1, Grosvenor Place, S.W. 1, 4 p.m.
6-9.—A.P.L.E.—14th Annual Meeting and Conference at Folkestone.
9-10.—NORTH BRITISH ASSOCIATION.—Annual Meeting at Edinburgh.
14.—N.G.C.—Central Executive Board, 2.30 p.m.
15.—I.G.E.—Finance Committee, 10 a.m.; Membership Committee, 11 a.m.; Research Executive Committee, 2.30 p.m.
16.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Porthcawl.
16.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Refractory Materials Joint Committee, 2.30 p.m.
17.—I.G.E.—Joint Lighting Committee, 2.30 p.m.
20.—LONDON AND COUNTIES COKE ASSOCIATION.—Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.
23.—S.B.G.I.—Council Meeting, 11 a.m.
26-29.—B.C.G.A.—Annual Conference at Manchester.
30.—I.G.E.—Gasholder Committee, 2.30 p.m.

Oct.

1.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
5.—I.G.E.—Research Executive Committee, 2.30 p.m.
5.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Commercial Meeting at Gas Industry House, 2.30 p.m. Discussion on Gas Mixing. Committee Meeting, 12 noon.
7.—I.G.E.—Joint Committee on Complete Gasification under Pressure, 3 p.m.
12.—I.G.E.—Board of Examiners, 10.30 p.m.
13.—I.G.E.—Finance Committee, 9.30 a.m.; Membership Committee, 10 a.m.; General Purposes Committee, 11 a.m.; Benevolent Fund Committee of Management, 12.30 p.m.; Council, 2.30 p.m.
19.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Gas Education Committee, 2.30 p.m.
26.—B.C.G.A.—Eastern District Conference at Lincoln.
27.—B.C.G.A.—Northern District Conference at Darlington.

Wales and Monmouthshire Association of Gas Engineers and Managers

General Meeting at Porthcawl

The General Meeting of the Wales and Monmouthshire Association of Gas Engineers and Managers will be held in the Grand Pavilion, Esplanade, Porthcawl, on Thursday, Sept. 16, when the Chair will be taken by the President, Mr. H. D. Madden, Engineer and Manager of the Cardiff Gas Light and Coke Company. Following the introduction of the President-Elect, Mr. J. Stephenson, Engineer and Manager of the Aberdare and Aberaman Consumers' Gas Company, there will be a Paper by Mr. W. R. Branson, M.Sc., A.M.Inst.C.E., of the Cardiff Gas Light and Coke Company, on "The Evaluation of Coals for Gas Manufacture," to be followed by a discussion.

At one o'clock the meeting will adjourn for luncheon at the Esplanade Hotel.

1937 "JOURNAL" DIRECTORY

Page 10. BRIDGEND. W. F. Edwards appointed E. & M., vice H. G. Horwood, resigned.

Page 40. LLANELLY H. G. Horwood appointed E., M., & S., vice H. Barker, deceased.

Page 50. NORTH MIDDLESEX. Acquired by South Eastern Gas Corporation. H. A. Probin appointed S., vice H. C. Burton. (Offices—84, Horseferry Road, S.W. 1.)

Page 66. SUNDERLAND. J. H. Curry, G.M. & S., deceased.

News in Brief

CURRENT EVENTS IN THE GAS INDUSTRY

Part of the Frontage of Manchester's new Town Hall extension will be used as a gas showroom which, it is hoped, will be completed in time for the Annual Conference of the B.C.G.A. on Sept. 26-29.

Of the 65 Miles of publicly-lighted roads and streets in Warrington, 50 are lighted by gas and 15 by electricity. The number of gas lamps is 2,437, the annual expenditure for gas and electric lighting being £12,394.

Copies of B.S. Specification No. 735-1937.—Methods for the Sampling and Analysis of Coal and Coke for Performance and Efficiency Tests on Industrial Plant may be obtained, price 3s. 6d. each, from the Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1.

A Five-Day Week has been adopted for a trial period by Manesty Machines, Ltd., manufacturers of automatic water stills and tablet compressing machines, at their new works in Speke Hall Road, Liverpool, 19. From the results of this trial the future policy of the firm will be determined.

Liberal Cash Prizes, it was announced by the Chairman, Mr. E. T. Mahony, at the annual meeting of the Cork Gas Consumers' Company, had been awarded during the year by the Company to those showing the highest proficiency in the examinations in gas cooking organized by the Company in the girls' schools of the City.

A New Scale of Charges has been adopted by the Bury Gas Committee. The first 60,000 cu.ft. is charged at 3s. 6d. per 1,000 cu.ft. Subsequent blocks are charged less until a consumer who uses over 2,500,000 cu.ft. is charged 1s. 3d. per 1,000 cu.ft. The charge for gas supplied through prepayment meters is 3s. 9·45d. per 1,000 cu.ft.

A Final Dividend of 7% and a bonus of 2½%, making 12½%, tax free, for the year ended June 30, 1937, is announced by the Staveley Coal and Iron Company. Another final dividend is that of the Thorncliffe Coal Distillation Company, which is paying 50%, making 75%, less tax, for the year ended June 30, 1937. The total for the previous year was 25%.

An Extraordinary Meeting of the shareholders of the Prescot and District Gas Company will be held at the offices of the Company, Moss Street, Prescot, on Sept. 8, to authorize the Directors to apply to the Board of Trade for an Order under Section 1 of the Gas Undertakings Act, 1929, empowering the Company to raise additional capital for the purposes of the Company.

The Coke Production of German pits and iron foundries during the first seven months of the current year totalled 23,750,000 tons, an increase of 3,600,000 tons compared with the corresponding period of last year. Coke production during the past four years has been more than doubled. The Ruhr coal output last month totalled 10,990,000 tons, against 8,970,000 tons in July of last year.

A Failure of electric light and power lasting for half-an-hour caused the Palace Theatre, Newcastle-upon-Tyne, where the play "Lights Out at 11 p.m." is running, to close at 9 p.m. Dismissing the obvious humour of the situation, one cannot help imagining that it was more than sentiment that made Dame Ellen Terry, among others, deplore the passing of gas stage lighting in the theatre.

Whist Score Cards prepared by the B.C.G.A. for the coming season are available in red and green. Although there has been a considerable increase in the cost of material, the Association are able to offer these cards at the same price as previous issues—*i.e.*, 8s. 6d. per thousand—as a result of the much larger quantity they have been able to print in view of increasing demand from members.

The Third National Coal Convention will be held at the Royal Hall, Harrogate, on Wednesday and Thursday, Oct. 6 and 7. It will be divided into four sessions, at each of which Papers will be read by qualified authorities. The Papers will be circulated to members in advance and time will be provided for a discussion after each Paper. The Convention will be opened by H.R.H. The Princess Royal, G.C.V.O., G.B.E.

The Contract for the lighting of the streets of Kingswood has been retained by the Wotton-Under-Edge Gas Company.

Threats of a Serious Shortage of Coke, states the *Chemical Trade Journal*, have led to a series of conferences of the Mines Department, the Board of Trade, leading coke producers, and iron and steel manufacturers, which may decide on emergency measures. Prices more than 50% above current contract figures are being asked by coke makers as contracts fall due for renewal, and a further rise may be necessary.

A Survey of Industrial Development for 1936, prepared by the Board of Trade with the co-operation of the Home Office and the Ministry of Labour, has been published. It shows that during the year 551 factories were opened, giving employment to 53,000 workers, at the end of December; 201 factories were extended, and 386 were closed down. Of the last 78 were closed on transfer to another area, and 20 on transfer of work to another factory in the same ownership.

With Disastrous Results to some jellies, the gift of a social worker to her sick daughter, rumour has it a certain dear old thing put them in the oven "just to take the chill off them." But hot ice cream is surely quite a new departure. For the second time in the last fortnight an electric refrigerator has caught fire in South Wales. Last week, it will be recalled, we reported such an outbreak at Abertillery; this week a very similar story comes from Newport, Mon., where what might have been a serious fire was averted by minutes. Part of the ice cream refrigerator in the stores of Messrs. Marks & Spencers became overheated, and the fire brigade were engaged for about an hour. They were hampered in their work by dense smoke.

Two Recent Publications of the International Tin Research and Development Council, Numbers A57 and A58, deal with the "Mechanical Properties of Some White Bearing Metals and Other Tin-Base Alloys at Various Temperatures" and the "Tensile Properties of a Series of White-Metal Bearing Alloys at Elevated Temperatures." The first of these publications is by C. E. Homer, B.Sc., Ph.D., and H. Plummer, and gives data about tensile and Brinell tests on typical tin-base bearing metals and on alloys made by adding cadmium to them in varying proportions. The second publication is by H. Greenwood, M.Sc., and reports work undertaken to examine the tensile behaviour of typical tin-base bearing alloys at temperatures up to 175° C. and to try the effects of additions of lead and cadmium.

The Works of Head, Wrightson, & Co., Ltd., well known to the Gas Industry as plant manufacturers, at Thornaby-on-Tees, which the members of the Iron and Steel Institute are to visit during their autumn meeting at Middlesbrough, are among the largest engineering works in the country. Founded almost 100 years ago, the four works of the Head, Wrightson organization now cover 64 acres, excluding the engineering works in Johannesburg. The principal unit at Thornaby-on-Tees contains iron foundries, steel foundries, pattern shops, heavy machine shops, forgings and stampings department, and a large structural department suitable for heavy constructional work, with an additional section entirely devoted to welding. The Company employs altogether about 3,000 men, excluding the overseas selling organization.

"The Equipment of Schools and Colleges"—Part II. has recently been published by the B.C.G.A. We learn there used to be a story of a lady who wrote to her son's college at Oxford to complain of the total lack of baths, receiving an answer from the bursar that, as the college terms lasted but eight weeks, he saw no need for such luxuries. To-day, however, a far different and more hygienic outlook exists in our ancient seats of learning, as shown by an increase in gas consumption at Oxford from 50,096,500 cu.ft. in 1934 to 51,211,600 cu.ft. in 1936, and at Cambridge from 51,000,000 cu.ft. in 1934 to 56,500,000 cu.ft. in 1936. Oxford and Cambridge are but two of the examples described and illustrated in the booklet. Technical colleges, training schools, domestic science centres, and the new Bloomsbury buildings of the University of London pay tribute to the close relationship between the work of the Gas Industry and the science of school and college planning.

Amalgamation and Grouping

Gas Consolidation and Uttoxeter.

Gas Consolidation, Ltd., has offered to acquire all the issued ordinary shares and/or preference shares of the Uttoxeter Gas Works, Ltd.

The offer is on the following basis: For each £100 10% Standard "A" ordinary shares, either £300 in cash or 280 "A" ordinary shares of £1 of Gas Consolidation, credited as fully paid. For each £100 7% Standard "B" shares, either £240 in cash or 224 "A" ordinary shares. For each £100 6% preference shares, either £120 in cash or 112 "A" ordinary shares. Cash at the rate of 21s. 6d. for each "A" ordinary share will be paid in respect of any such shares which, on allotment at the above rates, would fall to be allotted in fractions.

Interim dividend on Uttoxeter Gas Works shares will be paid to existing shareholders on Sept. 1 next. The "A" ordinary shares offered in exchange will rank for dividend from July 1, 1937. The offer is conditional on its acceptance by Sept. 10.

South-Eastern Offer to Windsor.

The South-Eastern Gas Corporation has made an offer to acquire from the shareholders of the Windsor Royal Gaslight Company their holdings of preference, original, and new shares.

For every five 10% basic original £20 shares of the Windsor Company, 225 ordinary £1 shares of the South-Eastern Gas Corporation are offered, *plus* a cash allowance of £2 10s. The offer for every five 7% basic new £20 shares is 157½ £1 ordinary shares of the Corporation and £1 15s. in cash. For every ten 5% preference shares of £10 nominal value, or every 12½ preference of £8 nominal value, 125 4% irredeemable cumulative preference £1 shares of the Corporation are offered.

Shareholders accepting the offer will retain the right to receive the interim dividend on their Windsor shares for the half-year to June 30, 1937, payable on Sept. 20 next. The shares of the Corporation offered in exchange will rank for dividend from Oct. 1, 1937.

The exchange of preference shares of the South-Eastern Gas Corporation for preference shares of the Windsor Royal Gaslight Company will produce the same income as that at present being received.

Cash at the rate of 20s. for each 4% irredeemable cumulative preference share and at the rate of 25s. for each ordinary share will be paid in respect of any such shares which, on allotment at the above rates, will fall to be allotted in fractions.

If the offer is accepted by holders of less than 55% of the shares of the Company, the Corporation reserves the right to withdraw the offer unconditionally. The offer is conditional upon acceptance not later than Sept. 15, 1937, and will be completed on Oct. 8, 1937.

It has been agreed that, if the offer is accepted, the present Directors of the Company will retire, and will be paid as compensation for loss of office a capital sum equivalent to seven years' purchase of their annual fees.

Modern Room Heating

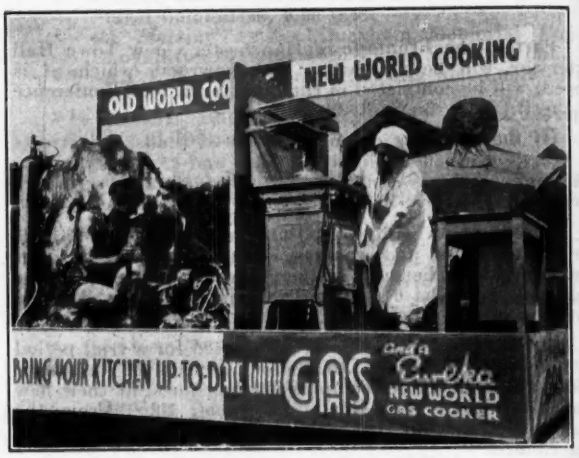
Parkinson's New List

An artistic new list entitled "Modern Room Heating" has been produced by the Parkinson Stove Company, Ltd., Stechford, Birmingham, 9. It is pointed out that it is vital for the health and comfort of members of the household that an equable distribution of adequate warmth should be provided throughout the home. To ensure this condition, the modern housewife has at her command the "Parkinson" ideal method of scientific house heating, the outcome of long experience and close application to the satisfactory solution of a vital problem. For the lounge, for example, it is claimed that equable warmth spreading to the four corners of the room can be secured by the Parkinson "Empire" Curvex or "Terminal" Curvex fires. These models are designed to give the widest distribution of radiant heat. For the dining room the Super-Ray series represented by the "Howard" and "Gresham" are stated to be a good choice. In the same way it will be found, runs the booklet, that the range of Parkinson modern gas heating appliances provides the ideal solution to the problem of the hall, the bedroom, and other rooms in the house.

Many beautiful models in various finishes are described in the new list. To the modern lines and high radiant efficiency of the latest Parkinson fires is added the luxury of automatic ignition. A lift of the top lever control and the fire lights itself. Stooping is, therefore, obviated.

The Parkinson Stove Company has also recently issued a colour finish chart, any colours from which can be supplied at the same price as for best black finish. Gold and silver are available at a small extra charge.

Baking *en Route*



This decorated lorry was entered by the Burnley Gas Department for the recent local Hospital Carnival. The display depicted on one side a cave man with his primitive methods of cooking, while on the other side the Department's Demonstrator, Miss Williams, was engaged in baking "Mr. Therm" biscuits. The gas supply for the cooker was provided from a cylinder loaned by the Wallasey Gas Department, and the biscuits were sold *en route* by boys dressed up as Mr. Therm. Approximately 700 small bags were sold, and the proceeds—just over £4—were given to the Hospital. The display aroused much interest, particularly the fact that baking was actually in process while the lorry was travelling through the streets.

British Standards Institution

Indexed Lists of Specifications and Methods of Test

The B.S.I. has issued its half-yearly Handbook, which includes the Annual Report, 1936-37 and Indexed Lists of British Standard Specifications to July, 1937.

The Annual Report for the year 1936-37 is of particular interest and gives some indication of the enormous amount of detailed work undertaken by the Technical Committees working under the three existing Divisions of this national organization—viz., Building, Chemical, and Engineering.

The usual sections showing the current lists of British Standard Specifications, the new and revised specifications recently issued, and those in course of preparation are followed by a complete subject index. A further section is devoted to an Index of the Methods of Tests contained in the various British Standards.

In view of the large number of British Standard Specifications now available for all branches of Industry, this half-yearly handbook and Index is of increasing value to all users and should be in the hands of all technical and purchasing departments of public authorities and firms throughout industry. Copies of the new Handbook (under reference CE. 4300) are available from the British Standards Institution, Publications Department, 28, Victoria Street, S.W. 1, price 1s. 4d., post free.

Gas-Operated Radio

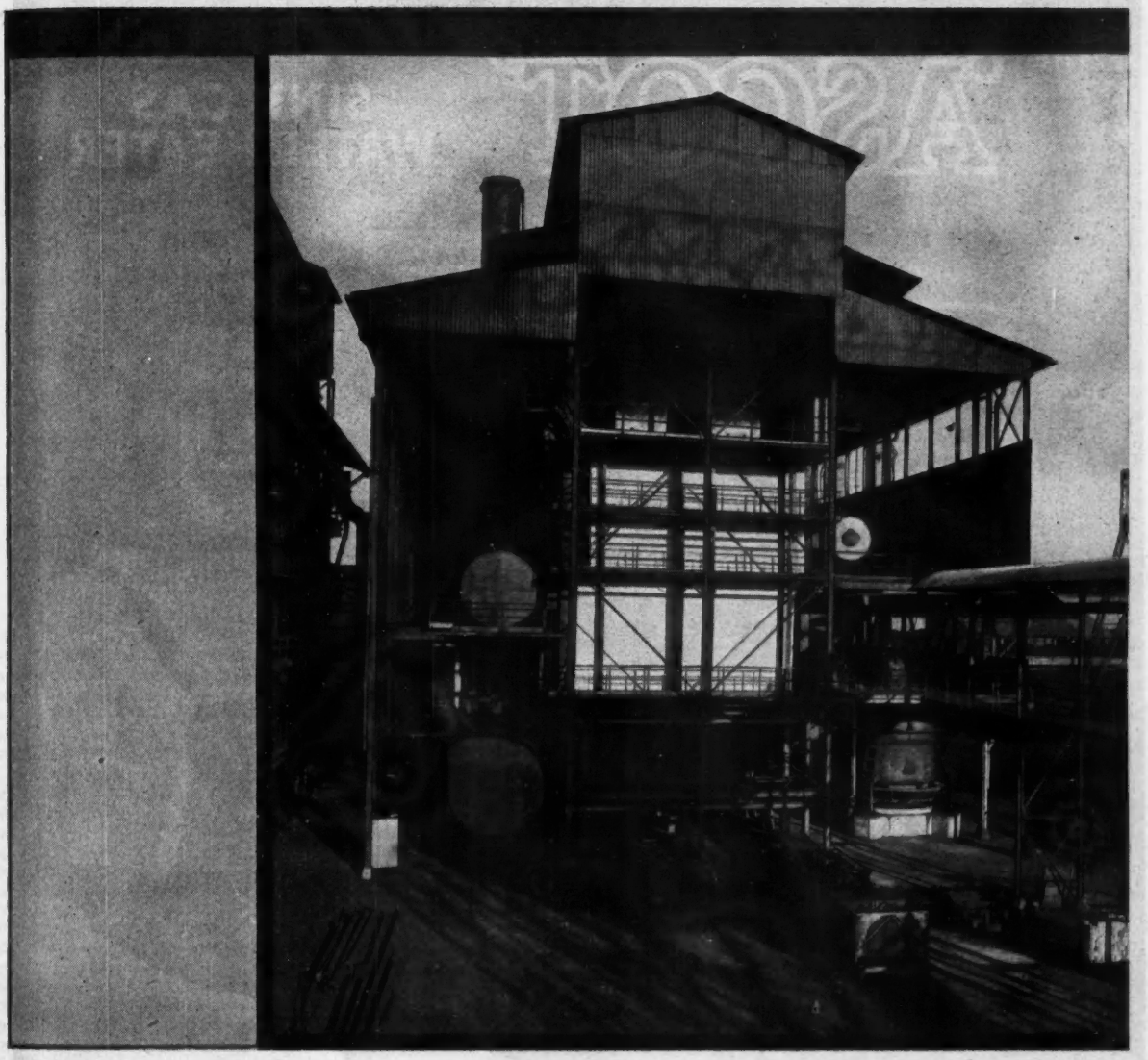
The "Thermo-Charger"

An interesting exhibit at the Radio Exhibition now running at Olympia is the "Thermo-Charger," which has been introduced by Milnes Radio Company, Ltd., Victoria Works, Bingley, who are exhibiting at Stand 88.

The "Thermo-Charger" is claimed to be a perfected version of the thermopile, which scientists have been striving to make a commercial possibility for many years. The appliance produces sufficient current to charge any low-tension accumulator by the direct action of a tiny gas jet on thermo-couples. The makers state the "Thermo-Charger" is probably forty times more efficient than any previous thermopile and will charge 2-volt cells from 2 to 3 amps.

The "Thermo-Charger" renders battery set owners independent of charging stations and, if used in conjunction with a Milnes H.T. supply unit (described in the "JOURNAL" for March 3, p. 584), makes a battery set an entirely self-supporting installation, needing no more outside assistance than does an all-mains radio.

RECENT W-D CARBONISING PLANTS



ROME

Thirty-two 103" W-D Continuous Vertical Retorts —arranged in two benches of sixteen, went into service in November 1936. The gas for heating the retorts is made in four mechanical producers and the retorts are capable of a total throughput of 304 tons of coal a day. The success of this installation has led to the placing in July 1937 of a ***repeat order for a further thirty-two W-D 103" Retorts.***

W-D

THE WOODALL-DUCKHAM VERTICAL RETORT & OVEN CONSTRUCTION CO. (1920) LTD
EBURY AND ALLINGTON HOUSES, 136-150 VICTORIA STREET, LONDON, S.W.1

Members of the Society of British Gas Industries

Telegrams "Retortical, Sowest, London" Telephone Victoria 8631 (6 lines)

T.G.S.

THE 'ASCOT' SINK GAS WATER HEATER

will deal with your customers'

washing up and 1001 other

household jobs.

ASCOT GAS WATER HEATERS LTD.

Head Office: 244 High Holborn, London, W.C.1 (Holborn 7107)

Works: North Circular Road, London, N.W.10

Branches: 51 King Street, MANCHESTER 2: 99 Corporation Street, BIRMINGHAM 2: 43a Queens Road, BRISTOL 8: and 35 Above Bar, SOUTHAMPTON

The above photograph shows the attractive new offices, built on modern principles and set among ideal surroundings, occupied by Cannon Iron Foundries, Ltd., at Deepfields, nr. Bilston, Staffs.

Co-Partnership in 1936

Ministry of Labour's Report

The Industrial Co-Partnership Association announces that the Ministry of Labour's Annual Review of Profit-sharing and Co-Partnership for 1936, just published, may appear depressing to some at first reading and the editorial comment of one contemporary on "a movement which no longer inspires any of the high hopes it generated . . . half a generation ago" may lead others to suppose that Co-Partnership is in the doldrums.

A closer examination, however, proves these fears to be groundless and analysis of the figures themselves affords several justifiable grounds of satisfaction. The total of Co-Partnership schemes recorded shows, it is true, a gradual and steady decline since the peak year of 1929, but set off against this is the fact that since the trough of the depression was reached in 1933-1934 the number of workers entitled to participate in such schemes is increasing at a greater annual rate than that of its previous decline. Last year's figure of 260,000 was only 6,000 short of the highest ever recorded. The average amount of bonus received by each participant in all the schemes recorded has steadily increased year by year during the period under review; excluding the 152 schemes of Co-operative Societies, last year's was at the rate of £12 9s. 11d., or a 6·3% addition to salaries and wages. Over a period of 27 years this rate has varied between 3·6% in 1921 and 6·7% in 1914. The latest figure, therefore, is satisfactory. It not infrequently happens that, although Co-partnership nominally exists in a business, owing to shrinkage of profits and other causes the most spectacular item of it—namely, profit-sharing, remains in abeyance. So it is an encouraging sign that in 1936 the 363 active schemes, in which a distribution of profit is known to have taken place, stand in the unusually high proportion of 87% of the total number recorded, whereas in 1927 this percentage was only 74 and the highest had been 84 in both 1933 and 1934.

The inference which may be drawn from this fact is that the lapse of time gradually eliminates the unsound schemes until only the most robust survive. This, of course, is all to the good. The decline in the number of schemes may be attributed partly to this cause, partly to the processes of amalgamation and consolidation which are continually at work, and lastly and in great measure to the fact that in many businesses what were commenced as orthodox schemes of profit-sharing developed subsequently into organizations catering for the social and industrial welfare of the workers and which, though embodying the true spirit of the movement, cannot officially be ranked as Co-partnership schemes at all.

The Co-partnership movement has always tended to thrive at the outset of periods of returning national prosperity and decline as industrial profits dwindle. But the depression of five years ago hit it less hard than might have been expected. British industry is in a healthy state and the objectives of the pioneers of the movement have become the jumping off points for fresh endeavour. The Industrial Co-Partnership Association has ample outside evidence of reviving interest in its aims which inspires high hopes of further progress in the years that lie ahead.

Teachers Visit Gas-Works and Showrooms

A party of lady members of the Burnley Association of the National Union of Teachers visited recently the Oswald Street Gas-Works and the gas showrooms of the Burnley Corporation. The visitors were welcomed at Oswald Street by the Engineer and Manager, Mr. A. F. Ames, and were then conducted round the Works. The visitors were finally taken by 'bus to inspect the showrooms in St. James's Street. At the conclusion of the visit, Mrs. Drake, Hon. Secretary of the Ladies' Bureau, thanked Mr. Ames and the staff who had conducted the party, and all agreed that they had had a very interesting and enjoyable visit. We learn from Mr. Ames that during the past few months parties from such bodies as sports clubs, welfare associations, and trade unions have visited the Works. There have also been many parties of school children. These visits are proving extremely popular, and the Gas Department frequently receive requests to be allowed to see the Works. The visitors generally express surprise at the many processes involved, and we agree with Mr. Ames that nothing but good can come from such visits.

Gas Undertakings' Results

Aylesbury.

The report of the Directors of the Aylesbury Gas Company for the half-year to June 30, 1937, states that after making provision for interest charges, the balance of profit available for dividends is £2,305. The Directors recommend dividends at the rate of 5½% per annum, less tax, on 5½% preference stock, and at 5% per annum on consolidated ordinary stock. These will absorb £1,912, and leave £303 to be carried forward.

Cork.

The annual report of the Directors of the Cork Gas Consumers' Company states that compared with the corresponding period of last year there has been an increase in the sale of gas. The returns from residuals also show a substantial improvement mainly due to the greater demand for coke. After placing £3,254 to the credit of depreciation fund, the balance of profit and loss is £4,532, out of which it is proposed to pay the usual dividend at the rate of 8% per annum.

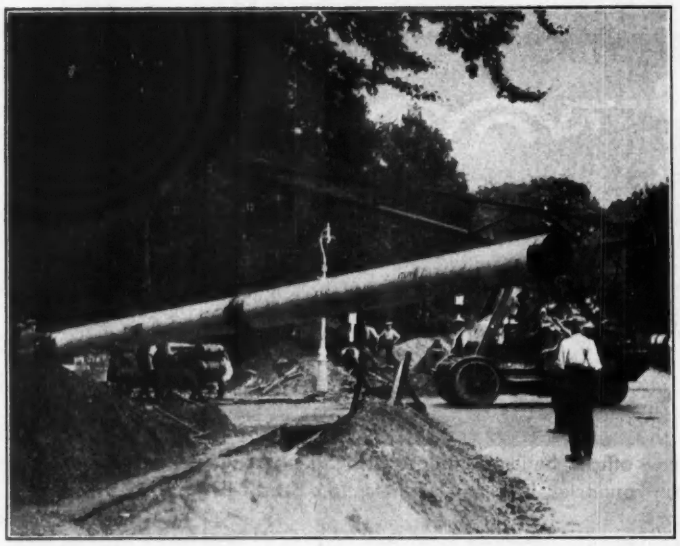
Waterford.

The Directors of the City of Waterford Gas Company report a profit for the year to June 30, 1937, of £4,109 (against £5,642), *plus* £3,304 brought in, making £7,413. After debenture interest, £780, and other interest, £138, had been paid, there remained a sum of £6,495, out of which there has been paid a dividend of 2½%, making 5% for the year. The sum of £4,815 has been carried forward.

Croydon Company Extend to Meet Rural Development

New Main to Addington

An interesting mainlaying job which has recently been undertaken by the Croydon Gas Company with a view to supplying the potential needs of the growing residential district of Addington, the ultimate development of which is estimated to be in the region of 10,000 houses.



A section of 24-in. Main being lowered into position.

The village of Addington which lies within the statutory boundaries of the Croydon Gas Company has until recently been quite rural. This is a village of considerable note as Addington Palace, the home of the Archbishops of Canterbury for a number of years, was situated within the parish. The house has now been converted into a country club and the adjoining grounds into an excellent golf course.

The Company was approached in the latter part of 1935 with regard to the supply of gas to an Estate consisting of 4,500 houses, apart from shops, cinemas, churches, and other amenities essential to an estate of this size. This Estate is situated approximately two miles south of the village of Addington. The Company had no mains in this district capable of meeting the demand for an estate of this magnitude. It was therefore decided to lay a boosting main from Croydon to Addington Village and to install a 24-in. Peebles governor at this point and continue with 24 in. and 20 in. mains through Addington Village and the proposed road leading to the Estate.

Assessing Potential Development.

To determine the size of the boosting main to be laid it was necessary to assess the potential development of the whole of this district. The acreage of land available for development was determined and multiplied by the average number of houses per acre allowed under the Town Planning Scheme. The result of these calculations showed that it would be necessary to supply a total of approximately 10,000 houses. This figure having been obtained it was an easy matter to find the amount of gas which the proposed boosting main from Croydon to Addington would be required to deliver, and it was finally decided to lay approximately 3,350 yd. of 24-in. main out of a total length of 6,000 yd., the remainder of this length of main being laid with 20-in. pipes.

The next consideration to be given in connection with this main was whether it should be laid with cast-iron or steel pipes. Tenders were obtained for steel and cast-iron pipes and also estimates for carrying out this work, and from these figures estimates were prepared of the comparative cost of laying cast-iron and steel pipes. It was found that the cost of laying the steel main would be slightly cheaper than the cast-iron, and in view of the fact that the sub-soil throughout the route of the proposed main was of a clean gravelly nature it was finally decided to use steel tubes.

Negotiating Curves.

The steel tubes were supplied from the Glasgow works of Messrs. Stewarts & Lloyds, Ltd.; they complied with the B.S.I. Specification and were made with spherical sockets and spigots, which enabled the main to be laid round curves in the road without reducing the capacity of the main. The tubes were coated externally with a special bitumen-asbestos compound coating. This coating was applied at the manufacturers' works with the exception of a short portion at each end of the tube where the weld had to be made. This portion of the pipe was protected after the test had been carried out on each length of main by clamping a mould round the tube and filling it with hot bitumen-asbestos compound.

The 24-in. section of the main was welded by means of the oxy-acetylene process, while the 20-in. section was electrically welded. Mr. P. Richbell, the Company's Mains Superintendent, is of the opinion that the latter process is very much more satisfactory on this class of work.

The 24-in. portion was laid under contract for the Company by Messrs. William Press & Son, and the 20-in. portion of the main was laid by the Company's own employees.

Under the Brighton Road.

The 24-in. section included laying it under the main Brighton Road and through a portion of the congested area of Croydon. This length of main was laid in an efficient manner by the Contractors, especially when one has knowledge of the difficulties which had to be contended with. One of the accompanying photographs shows a section of 24-in. main being laid in position by the Contractors.

There has been some considerable delay in completing negotiations with the Ministry of Health, &c., with regard to the development of the new Estate, and it is only quite recently that authority has been granted for the development to proceed. Practically the whole of the houses will be of the artisan type, and each one is being carcassed by the Croydon Gas Company for a cooker, wash copper, and points to all fireplaces. The whole of the roads on this Estate will be constructed in concrete and arrangements have been made by the Company to lay duplicate mains—*i.e.*, one in each footpath—which will involve laying approximately 30 miles of mains when the Estate has been fully developed.

This photograph of the New Main in course of laying was taken by Mr. P. Richbell, the Mains Superintendent, and clearly shows how the main can be carried round quite an appreciable curve in the road without the necessity of using bends.

THE APPLICATION OF RAWLPLUGS TO Modern Fixing Practice

Mr. R. N. LeFevre, M.Inst.Gas E., A.I.Mech.E., Officer in Charge of Training, Gas Light and Coke Company, gives some useful hints on applications of Rawlplugs to modern fitting work in the Gas Industry.

(*Continued from p 477.*)

Method of Fitting.

1. The following is the procedure to be adopted when fitting the "Sunhot" water heater on wall brackets—fig. 4:

(*a*) The bottom wall bracket N should be attached to the wall by means of three No. 16 by 2 in. Rawlplugs and screws, at a distance from the ceiling which will permit a connector to be fitted above the heater.

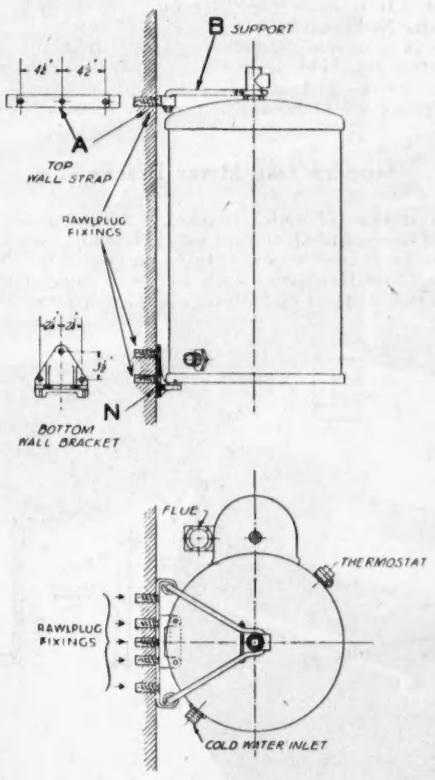


Fig. 4.

(*b*) The distance piece H is now placed on the bottom of the heater and two holes are drilled and tapped $\frac{5}{16}$ in. B.S. Whitworth thread. The two dowel pins T are now taken through the holes in the strap H and screwed securely to the base of the heater.

(*c*) The heater is offered into position and, after ensuring that it is perfectly vertical, the top strap A is temporarily held up while the positions for the screws S are marked on the wall.

(*d*) The heater is now taken down while the strap A is secured to the wall by No. 12 by 2 in. wood screws and Rawlplugs.

(*e*) The support B is placed below the tee on the expansion pipe and the bolt D is passed through and secured by a nut. The heater is again offered into position so that the two dowel pins engage in the holes in the bottom bracket and the turned-over ends of the support B engage in the collars on the strap A.

(*f*) Nuts C are tightened up.

It is imperative that the bottom bracket N is fitted perfectly plumb as otherwise the heater will not be vertical. This is best ensured by placing a spirit level over the holes R when placing it in position before making the holes for the Rawlplugs.

2. The procedure to be followed when fitting the "Equator" water heater on brackets—fig. 5:

(*a*) Where possible it is desirable to fit the bottom wall bracket N so that when the heater is fitted there will be sufficient head room above it to permit the top section of the outer casing to be raised for maintenance purposes. To do this the lower holes on the line XY should be at least 4 ft. 4 in. from the ceiling line. This point is not really important, however, as it is possible to gain access to the water ways from the bottom of the heater and, although it takes longer, it is a much easier method of getting the hands inside to remove scale. In fact, it might be said that this is an additional advantage of this method of fitting.

(*b*) Secure the top strap A to the wall at a distance above the bottom one, which will bring the retaining strap just below the joint of the top section of the outer casing. The centre hole F of this strap must be vertical above the top hole of the lower bracket N.

(*c*) Remove the lid, top section of casing and lagging, and fit the support E in one of the two alternative positions as shown.

(*d*) Screw the cast-iron pad F to the base of the heater in a position which will bring the flue pipe where

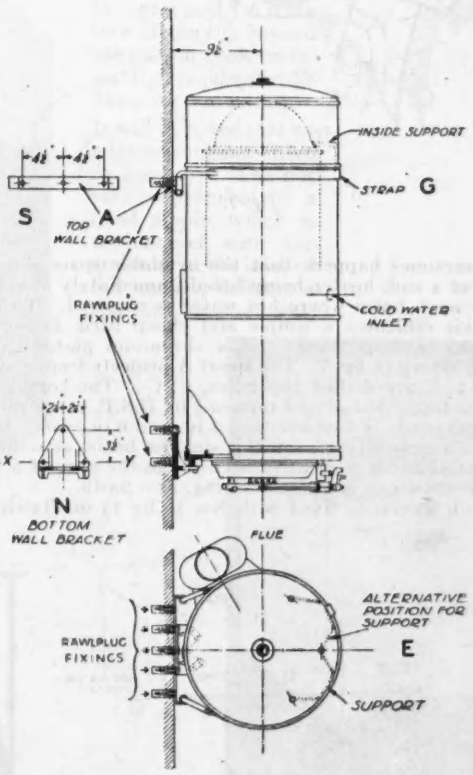


Fig. 5.

desired. This pad is attached by means of the holes M to a position normally occupied by one of the legs.

(*e*) Offer the heater into position so that the two dowel pins K engage in the holes R in the bottom bracket.

(*f*) Pass the retaining strap G round the heater so that the turned-over ends engage in the collars of the strap F, and secure by means of the nuts provided.

Fixing Small Water Heaters.

These may be either of the instantaneous or storage type and are usually supplied with integral fixing lugs or brackets for screwing direct to the wall. One popular type, the Newlyn, is shown in fig. 6. The heater A has

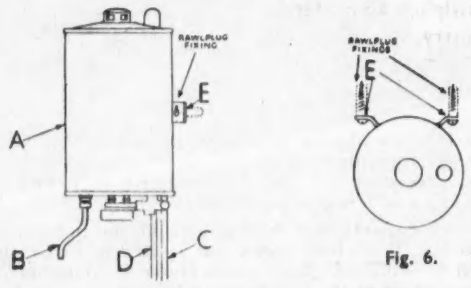


Fig. 6.

gas and water connections at D and C respectively, while the hot water outlet takes the form of a swivel spout, B. The heater is supplied with two lugs E welded on to the body. Pear-shaped holes are drilled in these lugs so that the heater can be hung in position after the screws have been fitted.

The heater should first be offered up into the desired position while the holes are marked off on the wall. No. 10 by 1½ in. Rawlplugs should now be fitted with round-headed screws run in until about a ¼ in. of shank projects. This will be sufficient to enable the heater to be hooked on securely.

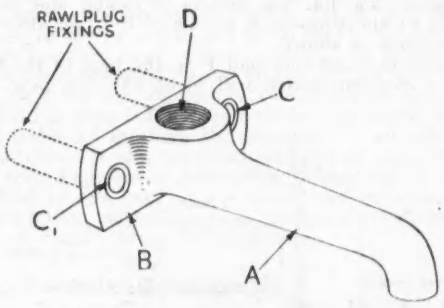


Fig. 7.

It sometimes happens that the available space does not permit of a sink heater being fitted immediately above the sink or wash basin where hot water is required. To overcome this difficulty a simple and cheap little fitting has been devised. It consists of a chromium plated bib or spout as shown in fig. 7. The spout A projects from a strap, B, in which are drilled two holes, C, C_1. The connection, D, at the top is drilled and tapped ¼ in. B.S.P. taper thread. The bib is made in two lengths—4 in. and 6 in.—and should be fixed immediately over the sink or basin at a height sufficient to bring it clear of utensils, in the case of a sink, or the head, when bent for washing, at a basin.

The bib should be fixed with No. 10 by 1½ in. Rawlplugs

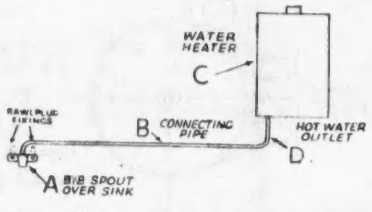


Fig. 8.

and chromium plated round-headed screws, the slots of which should be turned so as to be in line horizontally. The heater may now, of course, be fitted in any convenient location provided the outflow from it is above the level of the bib (see fig. 8). The connection from the hot water outlet from the heater to the bib should be run in ½ in. (nominal diameter) 17 S.W.G. chromium plated brass or copper tubing screwed ¼ in. B.S.P. This connection must be kept horizontal or fall from the heater to the bib. It must on no account be trapped or air locks will occur and result in the flooding of the heater. If the run of plated tubing be excessive it will be necessary to use pipe clips or strapped sockets as required. The tubing is quite light and No. 6, or, at the most, No. 8 ¾ in. Rawlplugs will be adequate to secure the clips to the wall.

Needless to say, both the clips and the screws should be chromium plated to match the finish of the rest of the work which, as it will frequently be on a tiled wall, can make an exceedingly neat arrangement.

Wall Type Hotcloset and Plate Warmer.

This is a vitreous enamelled warming oven which may be attached to a gas cooker in place of the more usual plate rack. It is generally a better arrangement, however, to retain the cooker plate rack and to fit the hotcloset as a separate unit on the wall. The appliance may be used for keeping cooked food warm, for warming plates, or for both.

The hotcloset should be fitted to the wall by means of Rawlplugs and screws through the two holes in the back of the end casting. The weight of the hotcloset when fully loaded is about 50 lb., and it may be subjected to rough treatment. It is desirable, therefore, to use 2 in. Rawlplugs of size No. 14 or 16.

Fitting is a simple operation. The hotcloset is offered into position and held perfectly level while the centres of the holes are marked off. It can then be removed until the Rawlplugs are fitted and it is ready to be screwed into position.

Modern Gas Meter Brackets.

The latest type of meter bracket is shown in fig. 9. It consists of two simple L-shaped brackets and a rubber stud. The whole arrangement necessitates the use of five No. 8 or No. 10 by 1½ in. Rawlplugs with screws to suit. The whole object of this method of fitting—apart, of course, from its

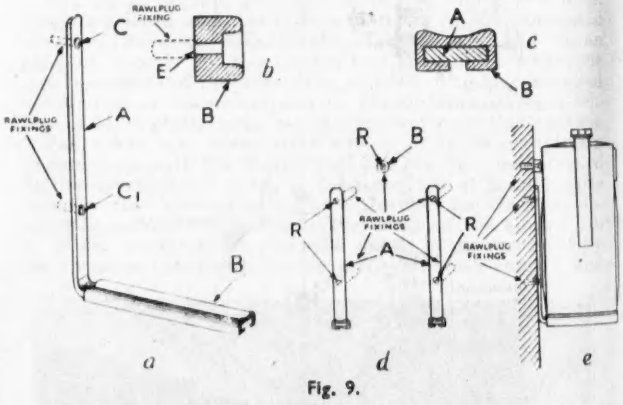


Fig. 9.

obvious neatness, cheapness and simplicity—is to insulate the meter from potentially damp surroundings which are so frequently the cause of auto-electrolysis.

The horizontal portions of the brackets, A (see fig. 9*a*) are covered with a special rubber sleeve, B, of suitable section. This is clearly shown in the cross-section, fig. 9*c*. Holes for screws are drilled and counter-sunk in the vertical portions of the brackets as shown at C, C_1. The object of the rubber stud is to keep the back of the metal clear of the wall, and the vertical portions of the brackets. Fig. 9*b* shows the stud, B, in section. It is drilled at E and is counter-sunk deeply so that there can be no possibility of the screw head touching the metal back of the meter.

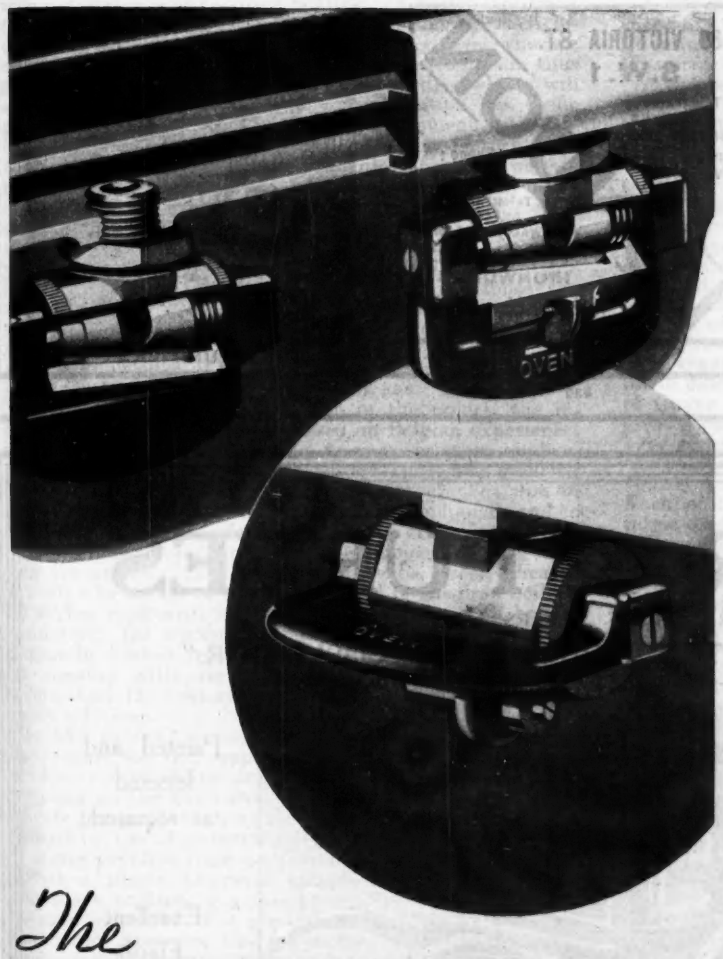
The layout of the brackets and stud will depend on the size of meter being fitted, but a typical arrangement is shown in fig. 9*d*. The brackets, A, should be at a distance apart such as will permit of the round studs on the bottom of the meter resting in the rounded surface of the rubber covering. The stud, B, should be above the level of the tops of the brackets so as to be above the " belly " of the meter. This will prevent its being thrown too far forward. As previously stated, five Rawlplugs will be required, and these are denoted at points marked R. The finished job with the meter in position is shown in part cross-section in fig. 9*e*.

(To be concluded.)

PARKINSON

UNIQUE FEATURES OF IMMENSE APPEAL

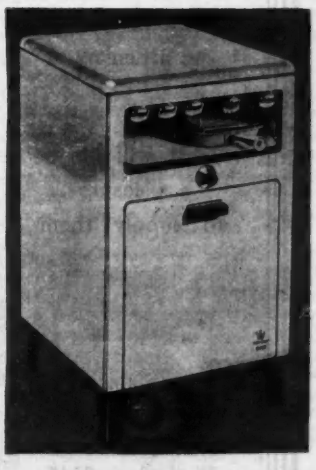
3 ADVANCEMENT IN TAP DESIGN



Another outstanding feature of the "RENOWN" which greatly enhances its appearance, is a distinct departure in tap design. This is demonstrated in the accompanying illustration, which also shows the safety locking device incorporated in the oven tap to render impossible the accidental turning on of the gas.

The automatic simmering position embodied in the hotplate taps is a valuable facility, which the consumer is quick to appreciate. A mere turn of the tap beyond the full on position instantly regulates the flame for simmering.

It will be noted that no adjustments are fitted to the taps. The gas rate is controlled by a fixed nipple, which in conjunction with the governor at the inlet of the cooker, delivers a constant flow of gas.



The RENOWN GAS COOKER

THE PARKINSON STOVE COMPANY LTD. BIRMINGHAM 9
London Showrooms: Terminal House, Grosvenor Gardens, S.W.1

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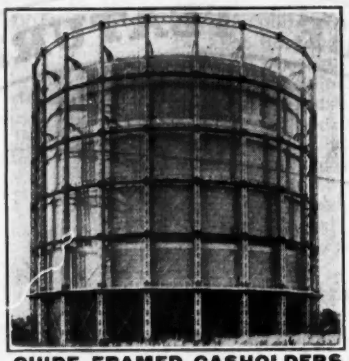
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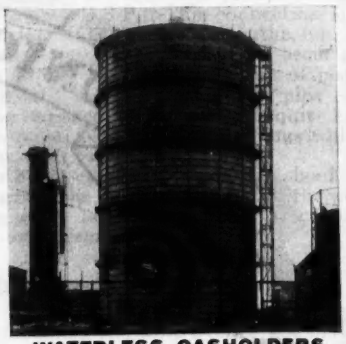
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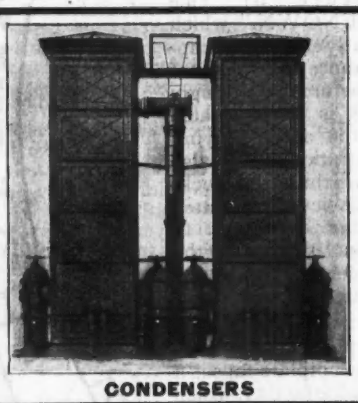
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POINTS FROM PAPERS BEFORE THE International Gas Union

Methods for the Development of the Industrial Use of Gas, including the Hotel Industry

Report of the Association des Gaziers Belges

This is an amplification of a report presented at the 1934 Conference [see "JOURNAL," 1934, 207, 572]. The views then put forward still hold good. The experience gained in the meantime serves to emphasize the necessity of the establishment of industrial tariffs on a rational and sufficiently flexible basis.

The present report provides a series of fully illustrated monographs extending over 120 large pages and devoted to the laundry, rubber and plastics, paper, baking, and soap industries, and to space heating. A useful feature is that descriptions are given of the operations in each industry which involve the use of heat. Engineers who are called upon to advise on process-heating problems are thus provided with some preliminary knowledge which will stand them in good stead when consideration has to be given to the replacement of existing equipment with gas-heated appliances or to the design of a new factory since due regard has been paid to economic aspects as well as to the question of labour and quality of product. In many instances the use of gas for particular purposes has become standard practice; for example, in the baking industry, where it is employed for a host of processes. In other cases the use of gas has merely been adopted in isolated instances as a very successful experiment. For those who are not pioneers, a knowledge of these applications will serve to encourage similar uses by other consumers in the same field, while for those possessed of the pioneering spirit, a knowledge of the heating problems of an industry will suggest numerous new outlets for gas.

Where, as is generally the case in the report, the information presented has been based on Belgian experience, very precise details are given. As regards other applications, information has been gathered from neighbouring countries and from the technical literature. The aim of the authors has been to describe typical appliances and to establish a comparison between gas and other fuels.

In the laundry industry, gas is employed in connection with (1) washing machines which may be directly heated or heated by means of steam generated in gas-fired boilers, (2) drying cupboards working in conjunction with hot-air circulators, (3) ironing by use of either internally or externally heated irons or gas-heated calendering rolls, (4) pressing with use of steam derived from gas-fired boilers, and (5) heaters for the preparation of soap and starch solutions.

In the rubber industry, gas may advantageously replace steam for the supply of heat for vulcanizing, temperature control being achieved by use of a servo-motor operating on the gas valve. In the manufacture of tyres, delicate temperature/time schedules are necessary and are realized by use of automatically controlled appliances fed by steam supplied from gas-heated boilers.

With a single American exception in which gas-fired boilers are utilized, gas is, apparently, not employed in the soap industry. The generation of steam by means of gas should, however, lead to economies, especially when accompanied by automatic pressure control. Soap-boiling pans are generally direct fired with solid fuel but could probably be heated more uniformly and to better advantage by use of a multiplicity of gas burners. Gas could, also, be advantageously employed for the supply of the hot air needed for the drying of the soap.

By far the largest section of the report is devoted to space heating and to its great importance to the Gas Industry. The story of the great progress which gas has made in this field is told with the help of illustrations of numerous installations typifying what has been achieved in private dwellings, offices, flats, schools, clinics, hospitals, maternity homes, convents, shops, factories, canteens, theatres, churches, &c. The installations described comprise both central as well as local heating, and reference is made to almost every conceivable type of modern appliance furnishing either convected or radiant heat. Special consideration is also given to heating by means of hot air—a system which lends itself particularly to large buildings such as theatres or churches in which intermittent heating only is required, though it is equally applicable to factories in which forced air ventilation is desirable for one reason or another. Among other matters dealt with in this section of the report is the effect of the extended use of gas for space heating on the load curve of a gas undertaking.

Studies on the Formation of Nitric Oxide during the Burning of Town Gas in Burners and Combustion Chambers

A Paper presented by P. Schläpfer to the recent Conference of the International Gas Union is reproduced in Bulletin Mensuel des Schweizer. Vereins von Gas- und Wasserfachmännern, 1937, 17, 147-160 (July).

A theoretical review of the thermodynamics and kinetics of the formation of nitric oxide from its elements and of the oxidation of nitric oxide to nitrogen peroxide is first presented and is accompanied by a series of graphs based on the equilibrium constants and rates of reaction concerned.

The drawbacks attending the occurrence of nitric oxide in coal gas are then considered from the aspects of vapour-phase gum formation and the production of explosive compounds during the compression of coal gas. Attention is also paid to the corrosive influence of the oxides of nitrogen formed during the combustion of town gas. It is concluded that, in gas appliances, these oxides play a smaller rôle in giving rise to corrosion than do oxides of sulphur.

As regards analytical methods for the determination of nitric oxide, the author is of the opinion that the method of Guyer and Weber (Brennstoff-Chemie, 1933, 14, 405) gives good results provided that the apparatus is calibrated very accurately. For very low concentrations, the apparatus of Seebaum and Hartmann (Brennstoff-Chemie, 1935, 16, 51) is recommended as the correction factor is smaller. Each of these methods depends on the oxidation of the nitric oxide by means of potassium permanganate solution.

Experiments on the formation of nitric oxide in flames and in combustion chambers were carried out. In the former case, a modified Bunsen burner with controlled admission of primary and secondary air was employed and the concentration of nitric oxide in the waste gas at different heights above the burner top, *i.e.*, in different temperature zones, was determined. In the latter case, an investigation on the concentration of nitric oxide in the waste gas in the combustion chamber of a Geipert coal assay apparatus was made at different rates of gas consumption. Special provision was incorporated for the control of the moisture content of the gas and air, and it was found that the concentration of nitric oxide formed at any temperature depends on the amount of water vapour present, a maximum being attained at all waste-gas temperatures when the moisture content of the gas-air mixture was equivalent to saturation at 14° C. Concentrations of nitric oxide as high as 200 parts per million by volume were obtained at a temperature of 1,150° C., while, at a temperature of 600° C., the value fell to 140 parts per million (Geipert apparatus) and to 84 parts per million (Bunsen burner).

In the carbonization of coal, the potential formation of nitric oxide when ingress of air is prevented is very small, experiments with a silica retort yielding values of the order of 0·2 to 0·34 part per million by volume according as the final temperature of carbonization is 1,100° C. or 1,230° C. respectively. Hence precautions against infiltration of combustion-flue products into the coal gas serve to minimize the presence of nitric oxide in coal gas. A further precaution, advocated in this country, is the prevention of the entry of the combustion products of the coke into the carbonizing chambers when the latter are discharged.

In practice, equilibrium concentrations are seldom attained, though they may be closely approached under certain conditions. Matters may be influenced by the catalytic effect of surfaces. Moreover, even though nitric oxide may be formed in equilibrium amounts during combustion, subsequent partial decomposition of the oxide into its elements may occur during cooling.

THE WORK OF

The Northern Coke Research Committee

Physical and Chemical Properties of Coke

The Northern Coke Research Committee, in its Annual Report for the year ended Dec. 31, 1936, states that its policy of encouraging the closest collaboration between producers and users of coke has been continued, and to this end the representation of blast furnace interests on the Committee has been further strengthened.

Closer co-operation between the three Coke Research Committees has been made possible by the establishment of a Coke Research Co-ordinating Panel under the Chairmanship of Dr. F. S. Sinnatt (Director of Fuel Research). This panel, which consists of the Chairmen and Technical Officers of the three committees and Mr. E. C. Evans and Mr. J. M. Ridgion (Secretary), of the Iron and Steel Federation, has met twice during the past year.

Chemical and Physical Properties of Carbon.

One of the most serious obstacles now hampering attempts to improve the quality of commercial coke and its efficiency in the blast furnace is the definite lack of fundamental knowledge of the formation and nature of coke. The Committee has initiated researches designed to remedy this deficiency, and the results obtained, while being of considerable intrinsic interest, have also provided valuable information relating to the more fundamental aspects of coke formation and combustion.

The molecular picture of solid carbon provided by X-ray investigations has shown that such problems as crystallite size, packing and shape, inter-crystallite adhesion, the accessibility of the inter-crystallite and inter-planar surfaces to various reagents, adsorption effects, the presence of metallic electrons, the presence and rôle of chemically bonded hydrogen, oxygen, nitrogen, and sulphur, the relationship of the atomic structure of a coke to that of the parent coal, &c., all require further investigation before any clear understanding will be gained of the factors which influence such commercially important properties as coke strength and combustibility. It is not possible in carbon investigations to employ the micrographical technique of the metallurgist; it is necessary to evolve new methods of attack. The wet oxidation test, which involves the determination of the reactivity of a carbon towards a solution of chromic acid in phosphoric acid, has provided a useful method of investigating the accessibility of the inter-planar surfaces of the graphite crystallites in a sample of coke. These studies have now been extended to various types of carbon. The effect of carbonization temperatures up to 2,000° C. on the susceptibility to oxidation by this method, the behaviour in this test of nitrogenous carbons made from pure organic compounds, and the effect of replacing the phosphoric acid by sulphuric acid, the variation of dichromate and acid concentration, have been investigated. The results obtained when carbons activated to different degrees were oxidized in solutions of chromic acid in different strengths of sulphuric acid provide an interesting confirmation of the concept of the nature of active carbons put forward by E. Berl and co-workers.

Since the original suggestion of Rhead and Wheeler that the formation of a solid oxygen-carbon complex plays an important intermediate rôle in the combustion of carbon, much experimental evidence has been forthcoming to support this view. It is therefore of importance to know something of the manner in which oxygen can become associated with carbon in the solid phase. U. Hofmann and co-workers have shown by X-ray investigations that in graphitic oxide the oxygen atoms have penetrated between the hexagon layers of the graphite lattice. L. Meyer and co-workers have shown that penetration between the layers also plays a part in the high-temperature combustion of graphite. It is also known that active carbon forms a stable complex with oxygen, and Berl's concept of the mesomorphous state of active carbons, which has been confirmed by the X-ray investigations of U. Hofmann and of Arnfelt, suggests that here also the inter-planar bonding of oxygen may be concerned. An investigation was therefore carried out in order to determine whether or not any similarity existed between graphitic oxide and the complex formed between active carbon and oxygen. This was done by studying the oxidizing action of these substances on a series of aromatic amines. The results of this investigation proved extremely interesting, as the oxidative actions of these substances showed a remarkably close and highly suggestive parallelism—*e.g.*, dimethylaniline oxidized with graphitic oxide at 100° C. gave three substances, (*a*) leuco crystal violet, (*b*) tetramethyl base, and (*c*) crystal violet. (The graphitic oxide contained some occluded sulphuric acid.) When dimethylaniline was oxidized by air in the presence of active charcoal (*a*) and (*b*) were obtained. When a charcoal previously treated with sulphuric acid was used (*c*) was also formed.

Laboratory Apparatus for Assessing Coke Strength.

The mechanical strength of black carbon can vary between very wide limits (compare, *e.g.*, sugar charcoal and electrode carbon), and the need has long been felt for an apparatus which would measure in a simple, reproducible manner some property of carbon closely connected with its mechanical strength. Such an apparatus has been designed. It consists essentially of a steel tube, 12½ in. long and 1 in. internal diameter, closed at each end by flat, hard steel screw caps to give an internal space of 12 in. × 1 in. The tube is mounted in a frame so that it can be rotated at a constant speed about a central axis at right angles to the length of the tube. In carrying out a test, 2 g. of coke graded between 14 and 25 B.S. sieves are placed in the tube together with twelve hard steel balls. The tube is then closed and rotated at 25 revs./min. for 800 complete revolutions, as determined by a revolution counter. The coke is then sieved and the result, provisionally termed the N.C.R.C. micro-strength index, is expressed as the mean of the percentage of the coke which, after sieving, remains on the 25 and 72 B.S. sieves in three consecutive tests. Results are in general readily reproducible to less than + 0·5%.

Tests have been carried out on a large number of commercial and laboratory-prepared cokes and black carbons. The micro-strength index apparently bears no simple relationship to the shatter index or the Cochrane abrasion index. Further work indicates that it gives a much more fundamental measure of the strength of the coke substance than either of these tests, the results of which are influenced largely by the amount of fissuring which has occurred in the coke. The outstanding merit of the test is, of course, its applicability to cokes prepared under laboratory carbonizing conditions. The effect of breeze blending and carbonizing time on the micro-strength index has been studied.

Influence of Carbonizing Conditions upon the Properties of Coke.

The enquiry carried out by Mr. Evans and the Director (Prof. H. L. Riley) into the relative efficiencies in the blast furnace of two cokes served to emphasize the importance of employing a coke uniformly graded and relatively free from breeze and small coke. The problem of producing hard, strong metallurgical cokes from poorly caking coals is probably one of the most important problems in the industry. Investigations have been carried out in an attempt to learn something of the fundamental factors which determine coke strength. It has generally been assumed that caking coals contain "binding constituents" which, during carbonization, pass through a plastic condition and provide bonding materials, giving coherence to the coked residue. The question arises, however, to what extent the strength of the coke is due to the fritting together of the carbon crystallites. It is quite conceivable that mechanical pressure, brought about by gas evolution and expansion during carbonization, brings the crystallites into closer contact and thus promotes frit-

ting, with a consequent increase of strength. An attempt was therefore made to determine quantitively the effect of the following factors during carbonization upon the strength of the coke—(*a*) mechanical pressure and (*b*) size grading of the coal. Experiments have been carried out with a coal "A" which was almost completely devoid of caking properties and another poorly coking coal "B," in four different size gradings. These coals were carbonized in a small laboratory apparatus under mechanical pressures from zero up to 20 lb./sq.in. Under zero pressure "A" gave a very weak coke which showed a zero N.C.R.C. micro-strength index. Carbonized under 20 lb./sq.in. the resulting coke gave a micro-strength index of the same order as that of a metallurgical coke. With coking slack "B," the coke strength passed through a pronounced maximum at a coking pressure of about 15 lb./sq.in., and thereafter decreased as the pressure was increased. This decrease in coke strength was associated with increased porosity. The size grading of the slack had an important effect on coke strength. The < 100 I.M.M. slack, carbonized under a pressure of approximately 15 lb./sq.in., gave a coke having a micro-strength index of the same order as that of a good metallurgical coke. The maximum strengths of the cokes obtained from 1/8-1/20 in., 20-40 I.M.M., and 60-100 I.M.M. slacks were not so great. The large effects of these relatively low pressures on coke strength indicated the important part played by mechanical pressures developed during carbonization in determining coke strength. The existence of an optimum pressure was clearly demonstrated. The cokes prepared in these experiments were also subjected to other measurements: electrical conductivity, total and apparent porosity, wet oxidation test, &c., and these measurements also showed some interesting correlations. It is hoped to obtain information in the near future of the pore structure of these cokes.

The Experimental Cupola.

Investigations on a scale intermediate between that in the laboratory and that in industry have been continued. Comparative cupola tests have been carried out employing straight cokes, cokes prepared from blends containing 5, 10, 15, 20, and 30% of coke fines, prepared in a large experimental oven, normal cokes and breeze-blended cokes prepared in a full-size oven, and such abnormal fuels as carbonized anthracite, electrode carbon, and retort carbon. The results obtained with the blends indicated that when burnt on this scale under closely similar conditions, breeze blending did not appear to cause any pronounced alteration in the combustible properties. Highly graphitized fuels such as electrode carbon and retort carbon behaved more efficiently than the metallurgical coke.

Sponge Formation.

The replies to the questionnaire on sponge formation, sent out in collaboration with the local Coal Survey Committee, indicated a certain unanimity of opinion that this phenomenon was due to two main causes: (1) Method of charging the oven and (2) the type of coking slack employed. Attempts have been made to prevent sponge formation by modifying the method of charging—*e.g.*, charging a sponge-forming coal as a layer at the bottom of the oven and a non-sponge-forming coal at the top. These experiments were only partially successful and indicated that further knowledge of the coking process was essential for a practicable solution of the problem.

TREATMENT FOR THE Prevention of Holder Discoloration

by
JOHN R. SKEEN
and
A. L. WARD
(Chemical Laboratory, the United Gas Improvement Company).

Reprinted from a contribution to the June, 1937, issue of the Canadian Gas Association *Messenger*.

Several palliatives for holder paint discoloration are known. One finding greatest favour is the selection of a paint colour as similar as possible to the inevitable discoloration so that the latter will be as inconspicuous as may be. This resort restricts lift painting to the several appropriate shades of red.

Another procedure consists in covering the water surface with oil. This does reduce the type of holder discoloration caused by the iron-organic complex, and, although a number of operating companies make use of it, widespread acceptance in the industry is unlikely because of inherent difficulties such as (1) the accumulation of dirt on the oily sheets which presents an unprepossessing appearance and (2) the blowing of oil to stairways and walkways which creates an accident hazard.

Recourse has also been made to various mechanical devices. For example, holder attendants may skim the exposed water surface continually or several times a day, or continuous mechanical skimming and filtering arrangements may be used to effect a substantial reduction in the discoloration rate. Such devices require constant attention and vigilance.

In one large commercial holder the water from the tank was circulated for cooling compressors and condensers, and the hot water was returned to the tank and stored. This procedure was observed to reduce discoloration markedly by allowing the colloidal suspension to coagulate and precipitate before returning to the tank. Then, too, the operation also kept the peripheral waters at a lower level of oxygen saturation. Pumping costs are prohibitive if the only objective is discoloration control.

Having ascertained the fundamental cause of the difficulty, a systematic search for a possible and satisfactory economic control became possible and was immediately begun. The ideal method consists in the creation of an unsuitable environment for organism growth, requires a minimum of attention, represents a low investment and maintenance cost, and involves no serious secondary difficulties.

To devise such a method, knowledge of the physiologic requirements and reactions of material was necessary. There were two immediate objectives: (1) To determine the *p*H range least favourable to these growths and (2) to add substances having a direct bactericidal action. Many combinations of this type of material were tried. Phosphates were tried because in low concentration they would effect marked changes in *p*H.* In general, these were found to stimulate the growth of the organism and also of *algæ* (microscopic green water plants). However, the phosphate also greatly reduced the amount of iron oxide. Hence the resulting scums were lighter in colour and were somewhat less objectionable than the dark-coloured scums formed in the absence of the phosphates.

Sodium bicarbonate additions, however, could be used for *p*H control and were free of the objection to the phosphates. It was found that increasing the *p*H in this manner created an environment which reduced but did not absolutely prevent scum formation. However, such weakly alkaline solutions affected many paint films so severely as to destroy them quickly. Hence the useful concentrations of alkali were not only costly but created secondary effects quite as bad as the original disease.

Attention was then turned to a combination of *p*H control with bactericidal reagents. Unfortunately, this variety of organism proved to be extraordinarily resistant to the commoner chemicals that are toxic to most forms of life. Carbolic acid, arsenic, copper, and mercury salts—the organism took them all in its stride. Various types of the newer fungicides and bactericides proved equally ineffective.

The conditions most favourable to these organic growths are warmth and a neutral or slightly alkaline water. It had previously been noted that rapid holder discoloration each year coincided with the advent of warm weather and that the trouble reached a maximum in the middle of the summer and early fall, tapering off in the fall and practically disappearing in the winter. Laboratory observations have established that the optimum temperature (most favourable temperature for growth) is about 85° F. Below about 45° the growth rate is very slow. If it were economical to maintain the temperature at the surface of

* The term *p*H refers to the effective acidity or alkalinity of a solution. A *p*H of 7·0 represents the neutral point, such as pure water. Higher values indicate increasing alkalinity and lower values increasing acidity.

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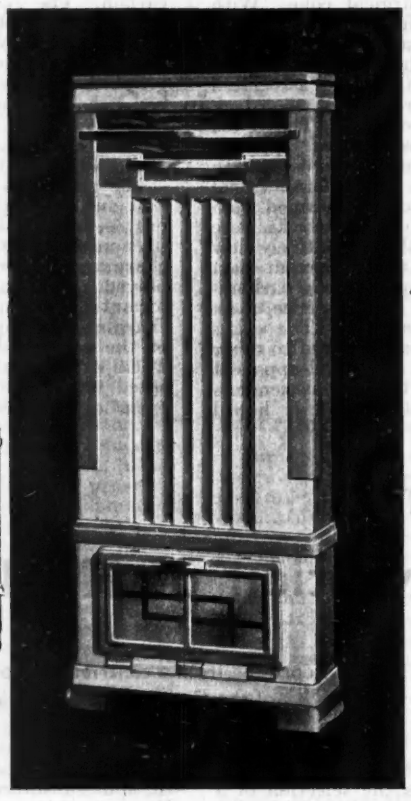

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holder waters below this point throughout the year, the growth of the organism could be kept below the scum-forming level. Such an approach is not as absurd as it may sound because it is now necessary to maintain the surface temperature above 32° throughout the winter.

Also, as before stated, in a moderately acid or highly alkaline medium the propagation rate decreases rapidly. With water at a *p*H of 4·5 or less, the organism would no longer be troublesome. Unfortunately, this cheap method of control is impractical because the rate of iron corrosion would be enormously accelerated. Similarly a *p*H above 8 greatly reduces the rate of growth, but does not entirely suppress it. Moreover, in a holder storing manufactured gas the absorption of carbon dioxide prevents the maintenance of a high *p*H. In addition, a high *p*H is relatively severe in its effect on the paint films.

Finally, by investigating the rate of growth of the organism in solutions of varying *p*H, to which were added various poisons, and bactericidal agents, such as mercury salts, tar acids, and oxidizing agents, it was found that if very small concentrations of sodium bichromate were added to water in which a specified *p*H was maintained by a buffer solution of dilute sodium bicarbonate the organism could be satisfactorily controlled even at optimum summer temperatures. Within limits the concentration of either component could be reduced providing the amount of the other component present was increased in proportion. That is, the product of the two salt concentrations must always exceed a definite minimum value if organic growth was to be kept below the scum-forming level. The determination of this minimum toxicity product is a matter of considerable economic importance, as it permits us to determine the relative and total amounts of sodium bicarbonate and sodium dichromate which will give complete protection at minimum expense for chemicals.

Curiously enough sodium dichromate reaches its optimum effectiveness at a *p*H which in the absence of the dichromate is found to be distinctly favourable to growth. That is, considered by itself the presence of the mild alkali favours the growth of the organism. Used alone, the dichromate, on the other hand, would not only be ineffective but would be reduced so rapidly that it would practically disappear from a holder in a few weeks. In combination, the two materials show an effectiveness which is much more than additive. Thus it becomes possible to reduce the concentration of dichromate to a point which makes the initial cost of the treatment a commercial possibility and which also prolongs the life of the dichromate greatly.

When first added there is a small initial loss of dichromate from reduction by the soluble iron and suspended material in the tank. After this has occurred there is little further reduction by the sludge at the bottom of the tank.

Incidentally, one of the greatest surprises of the investigation was the ability to so buffer a dichromate solution that it can be maintained in the tank of a holder containing not only constantly renewed large volumes of reducible gases but also enormous quantities of sludge consisting of light oils, leaves, iron in various states of oxidation, soot, dust, and just plain dirt. The quantity of the débris in holder tanks may be illustrated by the fact that one typical large holder recently cleaned contained 143,000 lb. on a dry basis and a second contained 94,000 lb. In view of this, the early attempts to use the treatment were confined to holders that had been cleaned and had their tanks refilled with fresh water until large scale tests had demonstrated that it was possible to treat the dirty water present in holder tanks that had been in service for years.

As a by-product of the treatment for suppressing organic growths, corrosion of the unpainted metal other than that caused by stray currents is reduced by upwards of 80%. This obviously desirable result is accomplished at no additional cost.

Although this process renders the water practically sterile in the ordinary sense of the word, it does not quite succeed in preventing the very resistant iron bacteria from growing. During the initiation of the process, the organism, in a desperate effort to survive, develops in a greatly modified form. In the treated waters, the growth now appears in the form of isolated colonies adhering to the metal. During the first few days of the treatment these colonies grow with amazing rapidity. They appear only on the unpainted metal. As these colonies die, they become brittle and disintegrate, causing some turbidity and sediment. Incidentally, the metal surface underneath one of the colonies is as cleanly etched as if it had been treated with an acid. This etching was the cause of considerable concern when first discovered. Since holder plates are about $\frac{1}{4}$ to $\frac{5}{16}$ in. thick it is obvious that severe etching would prevent the use of the treatment. Fortunately, the etching process does not continue for more than two or three weeks after the treatment is installed.

In an effort to keep the materials required to a minimum, advantage can be taken of the fact that as the size of a holder increases, the ratio of the surface of unpainted and immersed iron to the volume of water decreases. Therefore, the surface on which the colonies can grow, and the quantity of the "organic-iron complex" which produces discoloration become smaller in proportion to the amount of water present as the holder becomes larger. This means that the concentration of the salts required and, therefore, the relative cost, is less for the very large holders than for smaller holders.

The unpainted metal area of immersed lifts and tank is large in any case but varies with holder size as well as operation. In a given holder, the volume of water is fixed and may be from one to 20 million galls. The ratio of the volume of water in gallons to the surface of submerged, unpainted metal in square feet gives, perhaps, a clearer picture. For 2 million cu.ft. holders, this ratio is about 300; for 300,000 cu.ft. holders, about 25. Therefore, the surface upon which the colonies can grow and thus the quantity of iron-organic complex resulting becomes smaller in proportion to the amount of water present as the holder volume increases. Obviously, any treatment involving millions of gallons of water requires a large quantity of chemicals no matter how small the concentration may be. For example, a holder tank of 3 million cu.ft. capacity contains about six million galls. or 50 million lb. of water. To add any material to the extent of even $\frac{1}{10}$% would require some 50,000 lb. of that material. At ten cents a pound, an initial cost of $5,000 is involved.

In keeping materials requirement at a minimum, not only may the most favourable economic combination of salts be chosen, but, in addition, advantage may be taken of the increasingly favourable volume surface relationship with holder volume increase. In this way, the concentration of salts required and, therefore, the relative cost is less for very large holders than for those smaller. In terms of such large holders (greater than 2 million cu.ft.), the permissible amount of growth should cover not more than 1% of the unpainted metal surface, while for holders of and less than 2 million cu.ft. volume, growth should be restricted to 0·15% of the surface or less. This growth may be determined by the toxicity product of the two salts concerned and when applied to holders of various size, maintains growth below the scum forming level by a safe margin at any temperature.

Since the two chemicals mutually support each other, efficiency in scum control being measurable in terms of the product of their concentrations, the relative amounts of each can be varied over a rather wide range. The minimum permissible product of the two salt concentrations in per cent. by weight to insure perfect discoloration protection of holders of greater than 2 million cu.ft. capacity is 0·0002%. The minimum permissible concentrations of the two components are 0·0024% for dichromate and 0·08% for the bircarbonate.

Method of Treatment.

The dichromate is initially added in the form of sodium dichromate. Afterwards chromic acid may be added to maintain the desired salt concentration. The available alkalies are rather limited. As an alkali, lime is too insoluble; potash is too expensive and a plant food; borates are inadequate and expensive. This leaves soda as practically the only choice. Normal sodium carbonate (soda ash or washing soda) is the most suitable under average circumstances. The carbon dioxide present in the gas and already dissolved in the water will gradually convert the normal carbonate into sodium bicarbonate or baking soda. To add the bicarbonate initially is more expensive than to add the normal carbonate.

However, the normal carbonate, being a stronger alkali, is harder on paint than is the bicarbonate. Hence, for holders storing oil gas, natural gas, or other gases containing little carbon dioxide, it will be necessary to use the more expensive bicarbonate initially, unless a special alkali resisting paint is used.

Sodium carbonate and sodium dichromate are dissolved separately in water in drums and the nearly saturated solutions are then pumped into the tank. It may be remarked that since two holders in the same system were treated and painted, their glistening aluminium surfaces have attracted much attention and received favourable comments.

Holder waters always contain soluble calcium and magnesium salts which are precipitated by the addition of sodium carbonate. Precautions are, therefore, taken to prevent this precipitation from coating the paint. Similarly, special measures are sometimes necessary to ensure

George III
George IV
William IV
Victoria
Edward VII
George V
Edward VIII
George VI

In this, the Coronation Year of our Gracious King, George VI, we celebrate our 144th birthday, and are proud to record that, as leading manufacturers of gas works plant, we have been closely associated with the Gas Industry through eight reigns.

Newton Chambers & Co Ltd
Thorncliffe Ironworks Nr Sheffield
1793 1937

the absorption of carbon dioxide from the gas in order to effect the conversion of the carbonate to the bicarbonate.

Numerous details such as these, which have been worked out in practice, are of importance to the smooth working of the treatment.

Since the success of the operation depends upon the use of properly designed paints, arrangements have been made for the supervision of the installation of these treatments as part of the painting job by the paint manufacturer responsible for the paint formulæ employed.

The cost of treating six million galls. of water is about $1,000. Where holders are not equipped with a water circulating system, some provision must be made for circulating the solution from the tank to the cups after a rainfall.

The upkeep and servicing costs are moderate. Periodic analysis are necessary to show when renewal of chemicals is needed. There are slight losses as a result of dilution by rainfall and, in some cases, by steaming during the winter. There is also an additional slight loss of the dichromate by reduction.

Limitations of Treatment.

In general, all tank holders may be successfully treated. There are, however, some holders that cannot be treated profitably. These include old pit holders with an excessive water leakage and relief and other works holders which contain considerable tar.

The dichromate reacts with lead paints to form lead chromate, even though the paint is old. This ruins the coherence of the lead paint or primer and also the adherence between separate paint films or between the primer and the metal. A further difficulty develops from the fact that the yellow powder migrates to the surface of the top coats and stains them yellow, particularly in the case of aluminium paints. If, however, the lead paint or primer is two or more years old and has two or more coats of a lead-free paint over it, no trouble is encountered from the reaction between the lead and the dichromate. Although the reaction between dichromate and lead pigments may delay the addition of the anti-discoloration treatment it will in no case prevent the use of the treatment, because excellent lead-free primers and top coats are now available.

Finally, experience has shown that most ordinary paints possess insufficient resistance to prolonged immersion, particularly in an alkaline water, to be satisfactory. The treatment gives the water a slightly alkaline reaction. The need for proper paint choice is clear.

With these limitations, the treatment is satisfactory for all water-sealed holders and may be used with the assurance that all holder discoloration due to rusty water scums will be completely eliminated and that incidental holder corrosion will be sharply reduced.

Holder Painting.

The alternate exposure to light and water immersion to which holder lifts are subjected has long been recognized as one of the most serious environments to which commercial paints are exposed. The success of the treatment for the prevention of holder discoloration has increased the severity of the paint environment and has focused attention on the defects of commercial paint systems previously used for holder painting.

Whereas holder waters hitherto have been normally slightly acid due to dissolved carbon dioxide, the treatment provides a slightly alkaline water that is somewhat more severe on the paint immersed in it. The effect varies greatly with different paints, some of which are extremely susceptible to alkalies.

The second effect of the treatment is to reveal the paint defects previously hidden by the discoloration. A great many things happen to the holder paints. They chalk, crack, blister, lose adhesion and cohesion, become dangerously soft or excessively brittle. But if they are covered with a brown scum, no one can see the defects unless the paints actually peel off. By preventing the formation of scums that disfigure the paints but at the same time hide their defects, the treatment, so to speak, turns the spotlight on the paint.

The third effect is largely psychological, but it is nevertheless important. The holder water treatment makes the gas undertaking's employees and officials holder-paint conscious.

The final success of the treatment, therefore, required the selection or development of paint primers and top coats that would be definitely superior to ordinary holder paints. The work began as a rather extensive paint testing programme. More than 200 paint systems (primer and top coat) representing several examples of each known type of paint were tested. No entirely satisfactory system suitable for lift application was found among the commercial paints. The work then gradually branched out into a research on paint production.

Eventually it became necessary to continue the work in co-operation with a paint company possessing more appropriate facilities. The more experience was gained, the more clearly did it become evident that the close interrelation between the treatment and the paint problem required that the treatment be prescribed and that the most suitable paints be specified by one responsible organization possessing both the technical ability and the experience necessary to co-ordinate both problems.

Trade Notes

Manesty Machines, Ltd.

The well-known manufacturers of automatic water stills and tablet compressing machines, Manesty Machines, Ltd., have moved from their old address—viz., Manesty Buildings, College Lane, Liverpool, 1, to their new works at Speke. The present address is Speke Hall Road, Liverpool, 19. Telephone: Garston 1511. Telegrams: "Manesty, Liverpool."

British Aluminium Company, Ltd.

An artistic booklet dealing with the products of the British Aluminium Company, Ltd., Adelaide House, King William Street, E.C. 4, has recently been published. The publication contains many excellent photographs, some of various stages in the manufacture of aluminium, while others show the finished article in the forms usually supplied by the Company.

Air and Immersion Thermostats.

We have received from the British Thermostat Company, Ltd., Teddington Works, Windmill Road, Sunbury-on-Thames, Middlesex, a copy of their new catalogue section, number 309a, which has been prepared as a companion publication to the catalogue of room thermostats (Publication No. 306a). The catalogue gives full technical details of thermostatic switch for controlling water heaters, for commercial and industrial applications, and, in general, for use in installations operating at temperatures ranging up to 190° F. or, in the case of type K12, up to 400° F.

Copies of this catalogue are now available, and the Company will be pleased to send one to any engineer upon request.

Rawlbolt Collars.

When making fixtures in weak material it is an advantage to sink the Rawlbolt deeper than would be necessary when fixing to material of normal strength. By slipping Rawlbolt collars on to the bolt, and making a deeper hole, the Rawlbolt shield or fixing unit is necessarily dropped deeper into the material than would otherwise be the case.

By adopting this suggestion when tackling weak material, the danger of the material splitting will be largely avoided. The use of Rawlbolt collars also enables the range of Rawlbolts to take care of the fixing of articles, the thickness of which varies considerably. If the bolt length available is too great for a certain job, then by adding a collar or two, and sinking the bolt deeper into the material, the bolt length is automatically reduced by the thickness of the collars added; in other words, the use of Rawlbolt collars avoids unnecessary projection of the bolt. Rawlbolts are made by the Rawlplug Company, Ltd., Rawlplug House, Cromwell Road, S.W. 7.

CO_2 Recording.

The carbon dioxide percentage of flue gases can be ascertained at a glance with a "Cambridge" recorder.

The instrument employs for its operation the electrical method of gas analysis, which depends upon the difference in thermal conductivity between the constituent gases. The chief advantages claimed for "Cambridge" instruments are: Robustness—no delicate glassware is employed and all components are of rugged construction to withstand the rigorous conditions of boiler-house use; flexibility—the indicator or recorder may be any distance away from the metering unit, to which connections are made by a length of electric cable; response—the pipe line between the flue and the metering unit can be made short, with a corresponding small time lag in registering any change in the conditions; continuous readings are obtained—not a series of intermittent "samplings;" maintenance is simple and inexpensive—there are no chemicals to be renewed; accuracy within 0·5% of CO_2; and adaptability—the complete outfit can be operated either from an accumulator or from the electric supply mains. Current consumption is very low. CO_2, CO, and temperature at one or a number of points can be indicated or recorded on one instrument.

The instruments are made by the Cambridge Instrument Company, Ltd., 45, Grosvenor Place, S.W. 1.

Traffic Vibration

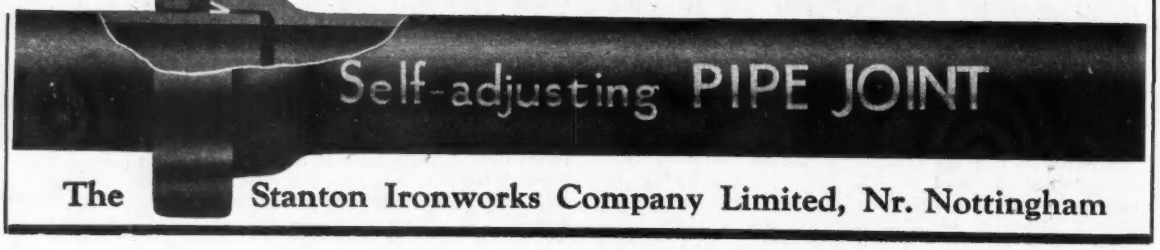
Rigid or Self-adjusting Joints?

Not many of the problems brought into being by the remarkable growth of road transport during the last decade are capable of easy solution.

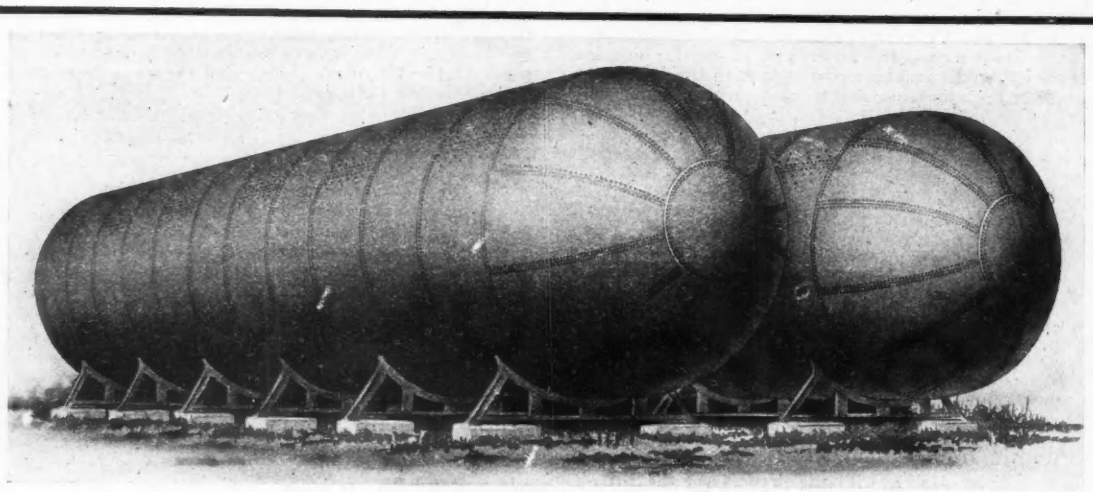
There is at least one exception, however. For instance, though much has been heard of the danger caused to historic buildings by traffic vibration, the harmful effects of such vibration on water and gas mains are not so apparent. To water and gas engineers responsible, however, for the maintenance of these essential public services, this was a very real problem until a few years ago, for rigidly-jointed mains could not be expected to withstand the severe vibration caused by modern conditions.

Some six years ago the Stanton Company introduced the Stanton-Wilson Self-adjusting pipe-joint to overcome this and similar difficulties. That it has successfully done so is proved by the fact that more than 1,500 miles of Stanton-Wilson mains have now been laid by over 750 public authorities.

The **STANTON-WILSON**



The Stanton Ironworks Company Limited, Nr. Nottingham



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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

The new Account opened quietly last week, and though business in most sections was restricted the general undertone remained firm. Japanese and Chinese securities again dropped sharply, but later some bargain-hunting buying led to a slight recovery. Gilt-edged stocks continued in good demand with hardening prices, and at one time the liveliness in this section seemed inclined to extend to other parts of the House, but the improvement was short-lived and business became irregular. It it evident that were it not for the Far-Eastern crisis London markets would speedily revert to active conditions. Home rails rallied on the Union's acceptance of the Wages Award, but in the absence of support prices eased off. There were several good features in the industrial section, and with the increase in the number of buying inquiries on a market short of supplies prices were marked up. Shipping quotations fell, though an increasing demand set in for tea and mining shares.

The Gas Market remained quiet and featureless throughout the week, and there was very little support even for the leading stocks. Prices generally continued firm, and, with the exception of a few *ex* div. markings, it will be seen in the Stock and Share Lists that quotations closed unchanged.

If the present strength of the gilt-edged market is maintained, it is possible that some adjustment in the values of gas debenture stocks can be looked for. It is true that compared with the highest prices for both these securities last year, gas debentures have not fallen to the same extent as gilt-edged stocks, but the margins are now approaching a figure when some improvement in the former can be justified.

Current Sales of Gas Products

The London Market for Tar Products.

LONDON, *Aug.* 30.

To-day's prices of tar products in the London market are as follows:

Pitch, 38s. per ton f.o.b.
Creosote, 6d. to 6¼d.
Refined tar, 3⅜d.
Pure toluole, 2s. 6d.; pure benzole, 1s. 9d.; 95/160 solvent naphtha, 1s. 8d.; and 90/160 pyridine, about 10s.; all per gallon naked at makers' works.

Tar Products in the Provinces.

Aug. 30.

The average prices of gas-works products during the week were: Gas-works tar, 23s. 6d. to 28s. 6d. Pitch—East Coast, 36s. to 37s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 36s. to 37s. 6d.* Toluole, naked, North, 1s. 10d. to 1s. 11d. Coal tar, crude naphtha, in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4⅜d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 4s. 1½d. to 4s. 3d. Naphthalene, £18 to £20. Salts, 90s. to 95s., bags included. Anthracene "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Aug.* 28.

New business is not too brisk, but, on the whole, prices are very well maintained.

Crude gas-works tar.—The actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch remains inactive with makers' prices at round 30s. to 32s. 6d. per ton, f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar.—The season is now drawing to a close, and prices are unchanged at 3d. to 3¼d. per gallon free on rails for export, and 3¼d. to 3⅜d. per gallon *ex* works in buyers' packages for home trade.

Creosote oil.—A good demand exists for all grades at the following prices: Specification oil, 5½d. to 5¾d. per gallon; low gravity, 6d. to 6¼d. per gallon; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—Despite the lack of new business values are well held as under: Pale, 97/99%, 4s. 3d. to 4s. 6d. per gallon; dark, 97/99%, 4s. to 4s. 2d. per gallon; and pale, 99/100%, 4s. 8d. to 4s. 11d. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Comparatively small quantities are changing hands at round 6d. to 6¼d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is valued at 1s. 5d. to 1s. 6d. per gallon, and 90/190 heavy naphtha at 1s. to 1s. 1d. per gallon.

Motor benzole can be secured at about 1s. 4½d. to 1s. 5d. per gallon.

Pyridine.—Prices are nominal at 7s. to 8s. per gallon for 90/160 grade, and 8s. to 9s. per gallon for 90/140 grade.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole . . .	0 9½	to	0 10	per gallon at works
Motor ,, . . .	1 3	,,	1 3½	,, ,, ,,
90% ,, . . .	1 4	,,	1 4½	,, ,, ,,
Pure ,, . . .	1 8	,,	1 8½	,, ,, ,,

Further Trade Notes

British Oxygen Company, Ltd.

The British Oxygen Company, Ltd., Thames House, Millbank, S.W. 1, has acquired a controlling share interest in the Odda Smeltewerke A/S, of Norway, which Company is the largest manufacturer of carbide imported into Britain.

Coke Oven Gas Separation Plant.

Gesellschaft für Linde's Eismaschinen A.G. (English address: 19, Selwyn Court, Richmond, Surrey) have received orders from Messrs. Fison, Packard, & Prentice, Ltd., Ipswich, for a large coke oven gas separation plant to be installed near Scunthorpe, Lincolnshire.

Pure hydrogen-nitrogen mixture at 4,300 lb. per sq.in., suitable for direct catalytic conversion into ammonia will be produced with a power consumption of 3,200 kWh. The order comprises the compression, purification, pre-cooling, and separation units and a plant for producing pure nitrogen from air. We are informed that the Scunthorpe plant will be the first of its kind in this country.

NEW VERTICAL RETORT PLANTS NOW IN REGULAR SERVICE

This installation, built for the Municipality of Svendborg, Denmark, is an interesting example of the modern Glover-West vertical retort plant designed for the smaller works. It is an eight-retort unit with fuel-gas producers equipped for breeze-burning, waste-heat recovery plant and electric lift. Coaling is by means of an automatic skip-hoist.

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THE SOCIETY OF BRITISH GAS INDUSTRIES · 1905 ·

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MANCHESTER: ALBION IRONWORKS, MILES PLATTING ■ **LONDON:** COLUMBIA HOUSE, ALDWYCH, W.C. 2

STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug. 27.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,767,439	Stk.	Mar. 15	8	8	Alliance & Dublin Ord. ...	170—175	...	...
374,000	,,	June 21	4	4	Do. 4 p.c. Deb. ...	95—100	...	...
558,890	,,	Aug. 9	7	7	Barnet Ord. 7 p.c.	158—163	...	...
300,000	1	Apl. 5	1/4½	1/9½	Bombay, Ltd.	26/6—28/6	...	27/3—27/7½
179,915	Stk.	Aug. 9	9½	9½	Bournemouth sliding scale ...	192—202	...	203
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	158—163	...	...
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	130—135	...	...
50,000	,,	June 21	3	3	Do. 3 p.c. Deb. ...	79—84	...	79½
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...	100½—100½
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	116—121	...	...
357,900	,,	Aug. 9	7½	7½	Brighton, &c., 6 p.c. Con. ...	152—157	...	...
649,955	,,	,,	6½	6½	Do. 5 p.c. Con. ...	135—140	...	138—139½
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	127—133	...	...
855,000	,,	Mar. 1	7	8	British Ord.	148—153	...	148½—149
100,000	,,	June 21	7	7	Do. 7 p.c. Pref.	140—145	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	108—113	...	...
120,000	,,	June 7	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...	...
450,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1½—2½	...	...
100,000	10	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1½—3½	...	...
150,000	Stk.	June 21	4½	4½	Do. 4½ p.c. Deb. ...	79—84	...	...
626,860	,,	July 19	6	6	Cardiff Con. Ord.	125—130	...	...
237,860	,,	June 7	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
98,936	1	Apl. 5	2/-	2/-	Colombo Ord.	1⅞—1⅞	...	...
24,510	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. ...	23/—25/-	...	...
739,453	1	Mar. 15	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	18/—20/-	...	...
296,144	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/-	...	...
1,775,005	Stk.	Aug. 9	5	5	Commercial Ord.	90—95	...	90½
620,000	,,	June 7	3	3	Do. 3 p.c. Deb. ...	74—79	...	...
286,344	,,	Aug. 23	5	5	Do. 5 p.c. Deb. ...	113—118*	−2	...
807,560	,,	Aug. 9	7	7	Croydon sliding scale ...	140—145	...	143—145
644,590	,,	,,	5	5	Do. max. div.	108—113	...	...
620,385	,,	June 21	5	5	Do. 5 p.c. Deb.... ...	113—118	...	...
239,000	,,	Aug. 9	5	5	East Hull Ord. 5 p.c....	98—103	...	...
185,355	,,	Aug. 9	6	6	East Surrey Ord. 5 p.c. ...	120—125	...	...
176,211	,,	June 7	5	5	Do. 5 p.c. Deb. ...	113—118	...	...
250,000	1	July 5	4	7	Gas Consolidation Ord. ...	20/—22/-	...	...
250,000	1	May 24	4	4	Do. 4 p.c. Red Cum. Pref.	19/—21/-	...	...
19,255,284	Stk.	Aug. 9	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	24/3—25/3a	...	24/6—25/-
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	82—85	...	83—84
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	99—102	...	99½—100½
2,993,000	,,	July 5	...	3½	Do 3½ p.c. Red. Pref.	100—103	...	101½—102½
8,602,497	,,	May 24	3	3	Do. 3 p.c. Con. Deb. ...	77—80	−2	77½—79½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	111—114	...	112½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb....	110—113	...	112
700,000	,,	Mar. 1	§25/5	3½	Do. 3½ p.c. Red. Deb....	95—100	−1	95
270,466	,,	Aug. 23	6	6	Harrogate New Cons. ...	120—125*	−2	...
213,200	,,	Aug. 9	6	6	Hornsey Con. 3½ p.c. ...	118—123	...	...
5,600,000	,,	May 24	8	12	Imperial Continental Cap. ...	143—148	−3	145—148
223,130	,,	July 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...	...
285,242	,,	Aug. 9	8½	8½	Lea Bridge 5 p.c. Ord. ...	158—163	...	...
75,000	,,	May 24	†10	†10	Malta & Mediterranean ... Metropolitan (of Melbourne)	150—160	...	...
392,000	—	Apl. 1	5½	5½	5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Aug. 23	5	5	M.S. Utility 'C' Cons.	101—106*	−1	...
968,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	96—101*	+1	...
360,075	,,	June 21	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
148,955	,,	,,	5		Do. 5 p.c. Deb. ...	115—120	...	...
125,000	—	July 1	3½	3½	Do. 3½ p.c. Rd.Rg.Bds.	96—99	...	...
675,000	Stk.	May 3	†6	†9	Montevideo, Ltd.	89—94	...	91
250,000	,,	Aug. 9	7½	7½	North Middlesex 6 p.c. Con.	157—167	...	...
396,160	,,	Aug. 9	5	5	Northampton 5 p.c. max. ...	110—115	...	...
300,000	,,	Apl. 19	†9	†7	Oriental, Ltd....	162—167	...	...
468,537	,,	June 7	8	8	Plymouth & Stonehouse 5 p.c.	160—170	...	168
621,667	,,	Aug. 9	8¼	8¼	Portsmouth & Gosport Cons.	164—169	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	104—109	...	...
73,350	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
441,275	1	May 3	1/-	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/—23/-	...	20/-
460,810	1	Mar. 15	-/10⅛	-/10⅛	,, ,, 4½ p.c. Cum. Pref.	20/—22/-	...	...
133,201	Stk.	Aug. 23	5	8½	Shrewsbury 5 p.c. Ord. ...	130—135*	−10	...
1,371,752	1	May 3	1/2⅝	1/2⅝	South East'n Gas. Cn.Ld. Ord.	24/—26/-	...	25/3
871,636	1	Mar. 1	-/10⅛	-/10⅛	Do. 4½ p.c. Red. Cum. Pref.	20/—22/-	...	21/-
498,818	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/6—20/6	...	19/9
450,000	Stk.	Aug. 9	4	4	Do. 4 p.c. Deb.	99—102	...	...
150,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	98—100	...	...
6,709,895	,,	Aug. 9	6	5	South Met. Ord.	105—108	...	105—106½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf. ...	130—135	...	133
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf. ...	98—101	...	...
1,895,445	,,	June 21	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
1,000,000	,,	July 5	5	5	Do. 5 p.c. Red. Deb....	110—113	...	110½
1,543,795	,,	Aug. 9	6	6	South Suburban Ord. 5 p.c....	120—125	...	122—123
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	110—115	...	113
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	95—100	...	...
250,000	,,	,,	...	§18/9	Do. 3½ p.c. Red. Pref.	98—101	...	...
888,587	,,	June 7	5	5	Do. 5 p.c. Deb....	115—120	...	...
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	97—102	...	...
200,000	,,	...	...	...	Do. 3½ p.c. Red. Deb.	95—100	...	...
427,859	1	May 3	9⅜	1/2⅜	S. Western Gas & Water Ord.	19/—21/-	...	19/4½
160,523	1	Apl. 19	-/10⅛	-/10⅛	Do. 4½ p.c. Red. Cum. Pf.	20/—22/-	...	...
110,000	Stk.	June 21	4	4	Do. 4 p.c. Red. Deb. ...	97—102	...	...
750,541	,,	Aug. 9	5½	5	Southampton Ord. 5 p.c. ...	111—116	...	114½
148,836	,,	June 7	4	4	Do. 4 p.c. Deb.	97—102	...	...
350,000	,,	Aug. 23	5½	5½	Swansea 5½ p.c. Red. Pref. ...	110—115*	−2	113—115
94,000	,,	June 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
1,076,490	,,	Aug. 9	6½	6½	Tottenham and District Ord.	135—140	...	136½
409,835	,,	,,	5½	5½	Do. 5½ p.c. Pref....	121—126	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	+1	112
371,850	,,	June 7	4	4	Do. 4 p.c. Deb. ...	97—102	...	98
750,000	1	Apl. 5	4	6	U. Kingdom Gas Cor. Ord.	20/—22/-	...	...
936,338	1	May 3	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	20/—22/-	...	20/9—21/3
740,933	1	June 7	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	17/—19/-	...	17/9
700,000	Stk.	Mar. 15	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...	97½—97½
373,939	,,	Aug. 9	7	7	Uxbridge, &c., 5 p.c. ...	147—152	...	...
133,010	,,	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...	...
1,371,138	,,	Aug. 9	7	7	Wandsworth Consolidated ...	141—146	...	...
1,620,615	,,	,,	5	5	Do. 5 p.c. Pref. ...	117—122	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref. ...	97—100	...	...
1,343,964	,,	June 7	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
383,745	,,	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
558,342	,,	Aug. 9	7	7	Watford and St. Albans Ord.	140—145	...	143—144½
200,000	,,	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...	...
200,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	121—126	...	...
200,000	,,	June 7	4	4	Do. 4 p.c. Red. Deb.	97—102	...	...
100,000	,,	,,	3½	3½	Do. 3½ p.c. Red.Deb.	95—100	...	...

a.—The quotation is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year. § Actual.

Stock and Share List continued overleaf.

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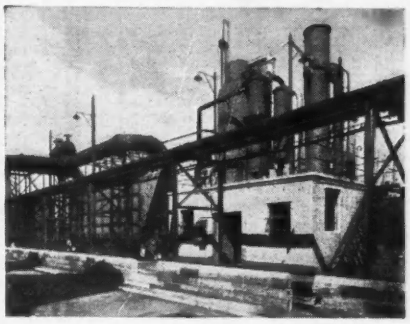

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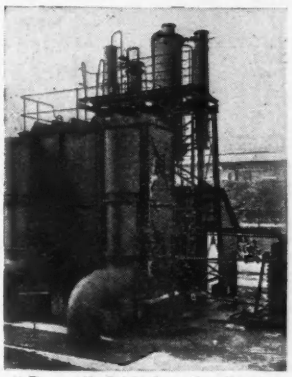

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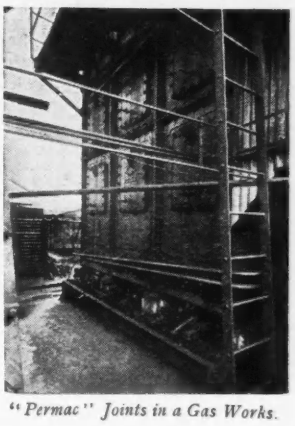

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Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Aug. 27.	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	July 19	6	5	Bath Cons.	119—121	...	...
1,667,250	,,	July 19	5	5	Bristol, 5 p.c. max.	117—118	...	...
120,420	,,	June 7	4	4	Do. 1st 4 p.c. Deb. ...	100½—102½	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100½—102½	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	120—123	...	...
274,000	,,	July 19	5	5	Newport (Mon.) 5 p.c.max. ...	101—106	...	...
13,200	12	Mar. 15	7	8	Pontyp'l Gas & W. 10 p.c. 'A'	13½—14½	...	...
13,600	10	,,	5	6	Do. 7 p.c. 'B'	12—12½	...	...
40,000	10	,,	5	6	Do. 7 p.c. 'C'	12—12½	...	...
140,778	Stk.	Aug. 9	5	5	Weston-super-Mare Cons. ...	110—112	...	...
64,338	,,	June 21	4	4	Do. 4 p.c. Deb.	96—98	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	157—160	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Aug. 9	6½	5	Chester 5 p.c. Ord.	104—109	...	...
92,500	,,	June 21	4	4	Do. 4 p.c. Pref.	97—101	...	101
36,430	,,	,,	3½	3½	Do. 3½ p.c. Deb.... ...	89—92	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	98—102	...	...
2,167,410	,,	Aug. 23	6	6	Liverpool 5 p.c. Ord. ...	124½—126½*	−1½	126½
245,500	,,	June 21	5	5	Do. 5 p.c. Red. Pref. ...	99—104	...	...
306,083	,,	July 1	4	4	Do. 4 p.c. Deb. ...	102—104	...	...
106,280	,,	Aug. 9	10	10	Preston 'A' 10 p.c.	206—216	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	147—157	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Aug. 9	8	8	Blyth 5 p.c. Ord.	165—166	...	...
732,000	,,	Feb. 15	5	5	Hartlepool G. & W. Co. & New	122—123	...	...
2,061,315	,,	Aug. 9	5¾	5	Newcastle & Gateshead Con.	24/—26/*a*	+/3	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	97—99	−½	...
776,706	,,	June 21	3½	3½	Do. 3½ p.c. Deb. ...	91—92	...	...
277,285	,	Nov. 2	5	5	Do. 5 p.c. Deb. '43...	108—109	...	...
332,351	,	Aug. 23	6	6	Sunderland 6 p.c. max. ...	139—141*	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Aug. 9	9	6	Derby Con.	150—160	...	...
55,000	,,	June 7	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	...	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	...	...	...
20,000	10	June 21	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Feb. 15	10	10	Great Grimsby 'A' Ord. ...	210—220	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	210—220	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—210	...	...
1,806,339	,,	Aug. 23	6	6½	Sheffield Cons.	144—148*	−2	...
95,000	,,	July 5	4	4	Do. 4 p.c. Deb.	100—103	...	...

Supplementary List of Stocks and Shares not Officially Quoted.

202,152	Stk.	Mar. 15	25/-*b*	25/-*b*	Ascot Ord.	102—107	...	...
128,182	,,	July 5	5	5	Do. 5 p.c. Pref.	108—113	...	...
573,156	1	May 24	5	5	Assd. Gas and Water Ord. ...	19/6—21/6	...	19/6
500,000	1	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/6—21/6	...	...
500,000	Stk.	Mar. 15	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
31,035	1	Aug. 23	...	-/4½	Associated Utilities 4 p.c. Pref.	17/—19/-*	...	20/-
100,000	Stk.	...	...	...	Do. 3½ p.c. Red. Deb.	95—100	...	...
17,000	,,	Aug. 23	8	8	Bognor Orig. Ord. 'A' ...	160—170*	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	160—170*	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	141—146*	...	...
37,440	,,	Aug. 9	10	10	Cam. Univ. & Town 10 p.c.max.	193—203	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	135—140	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	98—103	...	...
65,000	,,	Aug. 9	8¼	7½	Eastbourne 'A' 5 p.c. ...	158—163	...	...
198,000	,,	,,	7	6	Do. 'B' 3½ p.c.	128—133	...	...
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	...
130,000	,,	June 21	5	5	Do. 5 p.c. Deb.	115—120	...	...
24,000	30	Aug. 23	8½	8½	Great Yarmouth 8½ p.c. max.	44—49*	−1	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.	44—49*	+4	...
51,160	Stk.	June 7	5½	5½	Do. 5½ p.c. Deb.	120—125	...	...
152,600	,,	Feb. 15	8	9	Guildford Cons.	172—177	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	...	...
68,250	,,	June 7	5	5	Do. 5 p.c. Deb.	113—118	...	...
156,600	,,	Aug. 23	7½	7½	Hampton Court Cons. ...	158—163*	−2	...
73,620	,,	Mar. 15	8½	8½	Luton Cons. 'A'	166—171	...	...
107,960	10	Mar. 15	4	5½	Mid Kent Ord.	9—10	...	...
230,940	Stk.	Aug. 9	10	10	Oxford & District Ord. ...	203—208	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	110—115	...	...
126,193	,,	May 3	7½	7½	Peterborough Ord.	159—169	...	...
64,990	,,	Mar. 15	6½	7½	Redditch Ord.	127—137	...	...
166,850	,,	Aug. 9	8	8	Romford Ord.	155—165	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Mar. 15	5	5	Do. 5 p.c. Deb.	115—120	...	...
25,570	,,	Aug. 9	5½	5½	Rugby 5½ p.c. Pref.	125—130	...	...
25,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	106—111	...	...
42,750	,,	June 7	5½	5½	Do. 5½ p.c. Deb.	122—127	...	...
10,950	,,	Aug. 23	8	8	Ryde Ord.	158—163*	−2	...
136,191	,,	Aug. 9	7	5	Scarborough Ord.	115—125	...	...
27,825	,,	Aug. 23	8	8	Shanklin & Ventnor Cons. ...	158—168*	...	...
270,086	,,	Mar. 15	7	7	Slough Ord.	137—142	...	...
21,000	,,	June 21	5	5	Do. 5 p.c. Deb.... ...	112—117	...	...
28,872	1	May 24	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/-	...	...
28,866	1	Mar. 15	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...	...
137,730	Stk.	Aug. 9	7	7	Southgate & Dist. 7 p.c. max.	140—145	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
117,228	,,	Aug. 23	5	5	Swindon Cons.	106—111*	−2	...
60,425	,,	June 7	5	5	Do. 5 p.c. Deb.	110—115	...	...
64,380	,,	June 7	5	5	Torquay and Paignton 5 p.c. Pf	110—115	...	...
130,000	,,	Aug. 9	8	5	Wakefield Ord.	120—125	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	103—108	...	...
82,000	,,	Aug. 9	6	6	Weymouth Ord.	103—108	...	...
98,384	,,	Aug. 9	6	6	Wolverhampton 6 p.c. Pref....	125—130	...	...
160,000	,,	June 21	5½	5½	Do. 5½ p.c. Rd. Db	108—113	...	...
370,000	,,	Aug. 9	6	4	York Cons.	102—107	...	...
90,000	,,	June 21	5	5	Do. 5 p.c. Red. Deb. ...	105—110	...	...
133,640	,,	July 19	6½	6½	Yorktown (Cam.) 5 p.c Cons.	128—133	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	108—113	...	...
35,000	,,	June 7	5½	5½	Do. 5½ p.c. Deb.	123—128	...	...

a The quotation is per £1 of Stock. *b* Actual for Quarter. * Ex div.

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in

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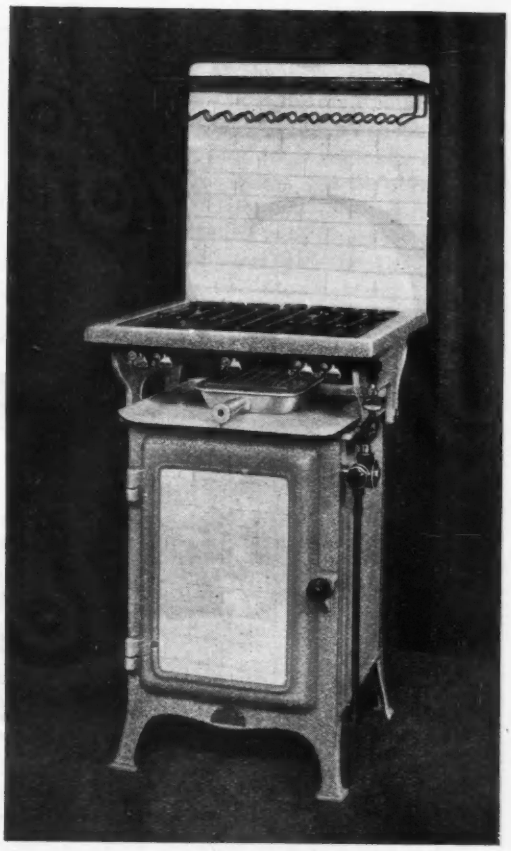

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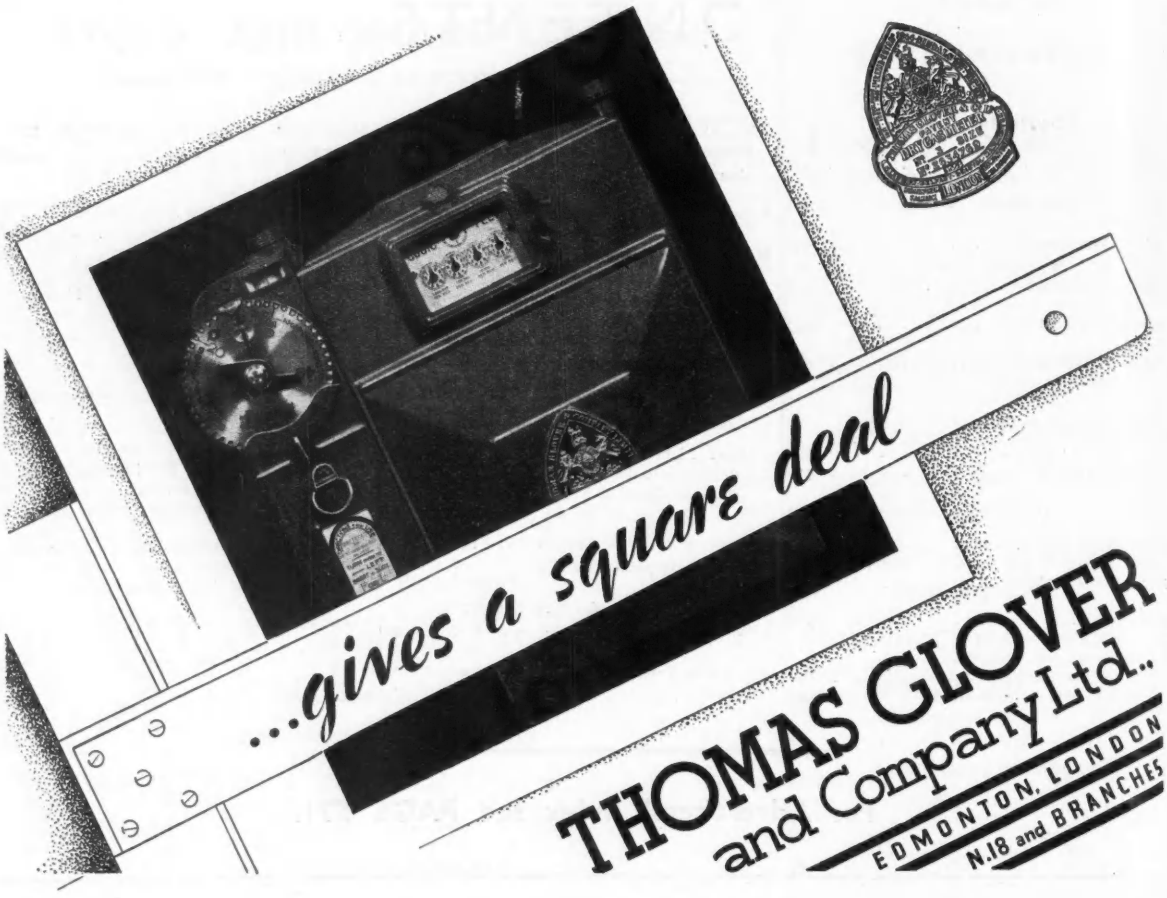
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